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Journal of Electricity and Western Industry

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March 1, 1921

San Francisco

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THE LEWMCO

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A McGraw-Hill Publication

ROBERT SIBLEY, Editor — Founded 1887 — H. W. L. GARDINER, Bus. Mgr.

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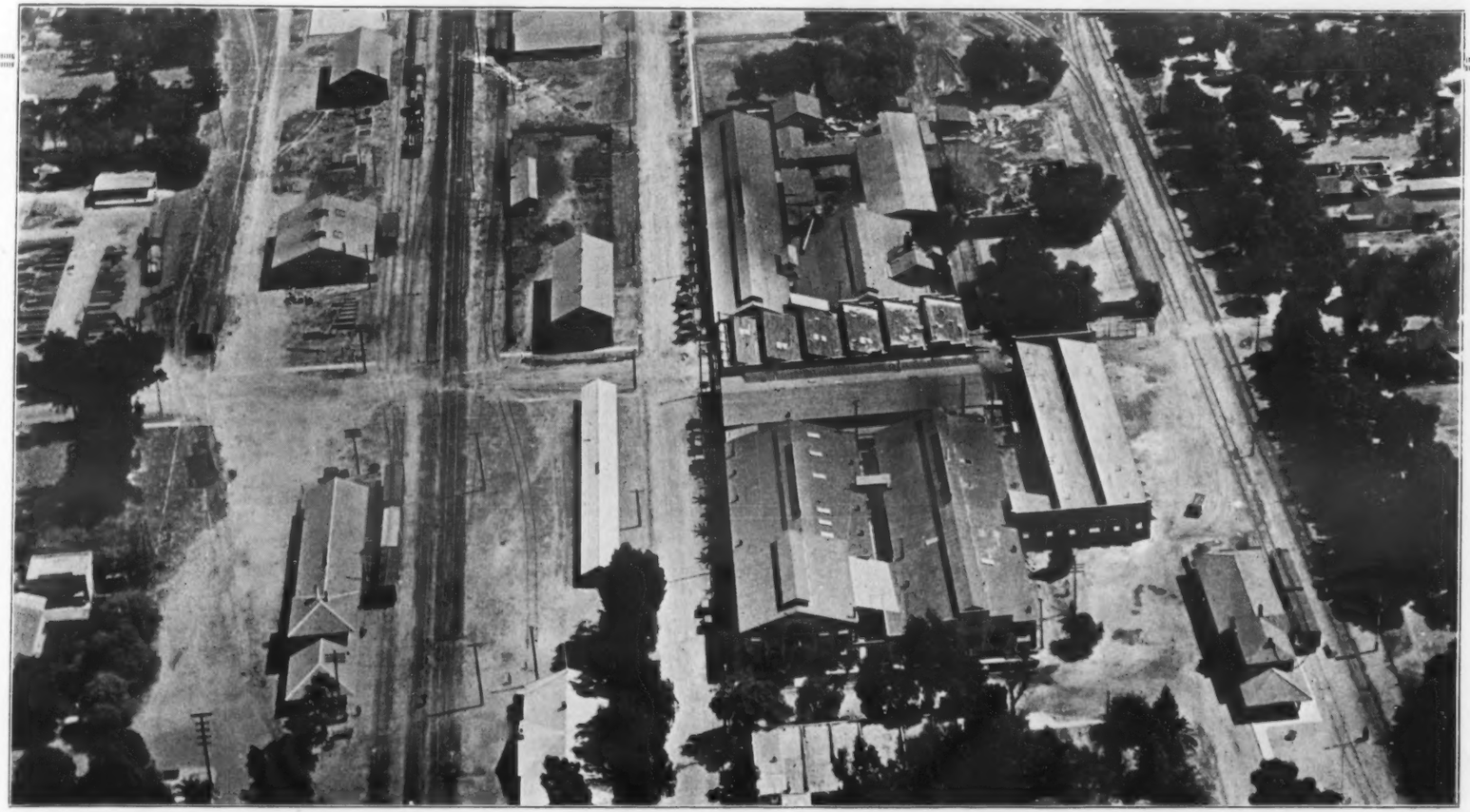

THE REALIZATION OF WESTERN VISION

A production valued at more than $15,000,000 realized in the past year has registered a substantial beginning for electrical manufacturing among the industries of the West, the output of which now totals four billion dollars. Characteristic of the breadth of vision of Western men this represents the results of endeavor and faith combined with grit and determination. The "Hotpoint" factory at Ontario, California, is typical of the growth of this industry, having increased the value of its output over sixty thousand per cent (from $5,000 to $3,000,000) in sixteen years.

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Journal of Electricity and Western Industry

A publication devoted to the upbuilding of the great industrial West and the countries bordering on the Pacific

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Interpreting Western progress through the application of electric power, light, and heat in industry and in the home

Vol. 46, No. 5 SAN FRANCISCO, MARCH 1, 1921 Per Copy, 25 Cents

THAT THE PEOPLE MAY KNOW

AT the hearings of the investigating committees which have been looking into the affairs of the various utility commissions in various parts of the West valuable information has been brought out which should not be disregarded. Such situations must be looked squarely in the face if the public service industries are to continue to perform their helpful service in the upbuilding of the West and have a one hundred per cent backing on the part of the people.

We shall at this time cite three instances that need attention. In the first place it is quite evident that great dissatisfaction prevails among the people generally, due to a misunderstanding of the electrical language. In the second place, the rational basis for ready-to-serve charges, service charges and surcharges is not generally understood and these institutions are causing widespread complaint, although such complaint is admitted by all parties to be unjust when the basic idea back of their use is finally gotten over to the public mind. And in the third place, investigations have brought to light vigorous protest from citizens generally concerning certain power company publicity covering security issues, stock sales and other investments in power companies, which has evidently conveyed to these representatives of the public only half a truth or has told the story of utility earnings in such a way as to be grossly open to misconception in the public mind.

As to the first objection, it would seem that the only remedy is a broad campaign of education among the people, at the same time doing away so far as possible with all use of technical terms in the common talk of the utility companies. The second complaint forcibly brings to light the necessity of abolishing the present scientific statement of charges in the interest of simplicity in order to avoid the complicated system of billing now in vogue. The surcharge, the ready-to-serve charge and the maximum demand charge should of course be taken into consideration in arriving at the individual rate upon which the consumer's account is carried, but there is no need for this to appear upon the bill. The consumer will thus receive just one straight out-and-out energy charge in language that he can understand and in terms so simple as to make complaints impossible.

The third complaint that has been brought to light is perhaps fundamentally the real thing above all else that has caused the misunderstanding in the public's mind, and it would seem that too great care cannot be given to the wording of publicity matter, particularly advertising matter covering bond and stock sales, so that the story concerning the security issue to which it refers tells only whole truths in such language that their meaning cannot possibly be misconstrued.

Facilities For Industrial Research

Active research work carried on along the lines of both pure and applied science in the particular field has come to be a prerequisite to success in modern industry. So important is this department of factory work that some of the larger manufactories have not scrupled to put as much as $100,000 into equipment and building alone for this purpose. In this respect the industries of the West labor under something of a handicap. The development here has been rather that of small independent factories than of a tremendous manufacturing center under one management—and there are few industries on this coast, even those under cooperative management, which can afford what would be an adequate outlay for research purposes.

On the other hand, Western universities, along with those of other parts of the country, have been suffering from a lack of funds and with few exceptions have been forced to neglect research work for the more clamorous demands of instruction. A possible solution of the problem is suggested by the experience of several of the eastern universities which have carried on constructive research work along limited lines in cooperation with individual manufacturers or groups of manufacturers. This idea could well be carried out in the West along more comprehensive lines, money for this work being provided by a group of manufacturers interested along similar lines and facilities of laboratory and library being contributed by the university. An example of what the universities of the West have already accomplished in this line is to be seen in the remarkable research work in high-tension phenomena carried on under Professor Ryan of Stanford, which is making possible the establishment of the new two hundred and twenty thousand volt record now under way in the West.

The advantages of this method are obvious. Not only would the conditions be such as could not be reproduced by an individual factory without an exorbitant outlay, but the group work which would

thus be made possible is the ideal method of research, as war experience has shown.

Discoveries made by such a group would, of course, be for the benefit of all. Some advantage is foregone in the relinquishment of individual rights in patents which may be developed—but a somewhat unselfish stand in this regard would nevertheless result in benefit to the manufacturer which would fully repay the outlay involved. This is not a speculative proposition, but is the basis upon which such research work has been carried on in other instances with extreme satisfaction to all involved. Such a case is that of the work undertaken by the Engineering Division of the National Research Council in the fatigue phenomena of metals, in which $30,000 was furnished by an individual manufacturer with no restrictions on the publication of results.

Such an experiment is along the lines of cooperation already so well established in the West and is offered as a serious suggestion toward the solution of one of the more troublesome of western industrial problems.

Why Not Be Frank?

Various attacks upon the welfare of public utility companies involved in bills before the legislatures of several of the Western states have recently made necessary campaigns of public information carried on sometimes by the power companies alone, sometimes by all public utilities affected. This is in line with the best interests of all concerned. Such open advertising is respected by the public as a whole and succeeds wherever the truth is indeed understood.

Much of the value of such campaigns is forfeited, however, where those advertising have seen fit to disguise themselves under a fictitious title such as "Consumers' League," purporting to represent a body of disinterested citizens. Such subterfuges never succeed in their purpose, the public unerringly scenting an "interested party"—in fact, they are inclined to think far worse things than the truth, which is that it is merely a justifiable case of one side presenting its argument. The opposing side is quick to use such phrases as "corporations hiding behind and alleged citizens' organization." There seems to be no conceivable advantage involved, in fact, but rather much to lose. Honesty is always the best policy. Frankness is at least respected—and is generally believed.

Keeping Chambers of Commerce Informed

Perusal of Chamber of Commerce literature from the principal cities of the West leaves one with the conviction that the power industries of these districts have neglected an opportunity for legitimate advertising. One such pamphlet distributed on the train to incoming tourists and designed to present the advantages of the district from the standpoint of prospective residents and factory owners alike omits all mention of the power facilities of the region. The only reference to the electrical industry made is an inaccurate figure on undeveloped water power in the West.

This is not true of all such development bodies, of course, some of whom fully appreciate the value of electricity to their communities. Even these more progressive groups, however, would profit by a greater accuracy and variety of statistics. The chambers of commerce are to blame for their lack of initiative in looking up statistics which are available on so important a subject, but after all it is the concern more particularly of those most interested. The electrical industry should see to it that the local chambers of commerce are conversant with the electrical story from all its self-interest aspects.

The importance of this avenue of public education has been recognized by the California Electrical Cooperative Campaign in the program outlined at a recent meeting of the Advisory Committee. It is proposed to establish electrical committees in every chamber of commerce throughout the territory covered by the campaign which shall keep in touch with developments in the electrical industry and toward which this industry will feel a special responsibility.

A still later move in this direction is the proposal of the Pacific Coast Geographic Division of the National Electric Light Association to make its annual meeting in May one of coast-wide influence, and to that end it proposes to hold an open meeting to which would be invited not only electrical men, but leading newspaper men, magazine writers, farm bureau men and representatives of civic bodies, and more particularly the governing bodies of cities and towns, as well as leading men from all lines of industry. Journal of Electricity and Western Industry gives this broad movement its heartiest endorsement.

More Concerning the Marshall Plan

Considerable controversy seems to have arisen through the publicity given the plan devised by Colonel Marshall to utilize the waters of California rivers to irrigate twelve million acres in the Sacramento and San Joaquin valleys. The San Francisco Section of the American Society of Civil Engineers and the Engineering Council have taken occasion to pass resolutions declaring the plan as "physically, legally and financially impossible of accomplishment," while the association that is disseminating information on the Marshall plan has come back in vehement rebuttal.

One point is brought out by all of this discussion—namely, that there is a difference of opinion as to the manner of best developing the water resources of California so that the irrigationists, the reclamation people, the power companies and the citizens of the state will be best served. Before rushing ahead and entering into some great project which may or may not best serve the people, the water problems of California should be investigated by a competent committee. Such a committee should be composed of executives—possibly fifteen in number, representative of the state's diversified industries—who are used to planning big projects and whose ability has been demonstrated in the business world. The records of the State Engineer's office, the Water Commission and the Railroad Commission should be put at their disposal and they should be

empowered to call upon engineers of known ability in the solution of water problems to act in an advisory capacity. The findings of such a committee would be free from any political influence and would be believed by the people of the state.

Present local developments should not be held back to await any state-wide action as these local developments, being needed at the present time and the most efficient under the present conditions, can easily be incorporated into a state-wide system if such a one is ever found feasible and developed.

A New Idea For Utility Service

Wigginton Creed, president of the Pacific Gas & Electric Company, advocates the use of "public service industry" in all discussions wherein public service corporations are involved. It would seem that this suggestion is an able and constructive thought in helping to put over the utility ideal to the people, and Journal of Electricity and Western Industry throughout its editorial vision shall endeavor to spread broadcast throughout our industry this very constructive and helpful contribution on the part of Mr. Creed.

The Contractor-Dealer and His Name

While discussing this subject of change of name, there is considerable urge in the contractor-dealer industry to find a more suitable name both for this industry and for those engaged in the work. The word contractor-dealer does not place sufficient emphasis on the word "dealer," which, after all, is the fundamental unit to be emphasized when relating to the four branches of the electrical industry. Members of the electrical industry in all its branches might well give constructive thought to a renaming of this important branch of our industry.

The Situation Among City Attorneys

The city attorneys of various municipalities of the West have been quite active recently in their complaints that the smaller municipalities are inadequately manned to care for rate fixing matters and appearances before utility regulating bodies. It would seem that there is some justice to this complaint. However, records of the past indicate that the various utility regulating bodies have been unusually careful in cases of inadequate representation to see to it that the trained engineering staff of the utility commission itself be placed at the service of the complainant in full sympathetic helpfulness, so that no injustice be given to the municipality.

It would seem that one way of obviating this difficulty, however, would be for the cities affected, through cooperative organizations of their own, to institute a cooperative board that might be empowered to represent all of the municipalities at the various hearings and thus by combined effort be fully and completely prepared to present their case. It is interesting to note in passing, however, that upon direct questioning of the complaining city attorneys on the part of Senator Inman, chairman of the California legislative committee investigating the Railroad Commission of that state, the representative of the city attorneys present had to admit that he had no specific concrete case in mind in which he could state positively that the Railroad Commission had been negligent of its duty in fully covering the case of municipalities in such instances of inadequate representation which have occurred in the past.

The Value of the Conclave

An innovation has entered the proceedings of the Pacific Coast Division of the N. E. L. A. There has recently been held a conclave, or an inter-session discussion of engineering matters pertaining to Division affairs. To the constructive thought of L. M. Klauber, chairman of the engineering committee, G. E. Armstrong, secretary, and H. A. Barre, electrical engineer of the Southern California Edison Company, great credit is due for having put over one of the most successful and helpful gatherings of this nature. The meetings have been well attended by engineers throughout the Division and the discussions morning, noon and evening have proved of great value. The close attendance at meetings and the interest that has been shown at these meetings unquestionably will result in central station executives encouraging their men to attend similar gatherings in the future, to the extent of continuing the paying of the expense accounts for attendance.

The Electrical Show

Great interest is being manifested throughout the West concerning the matter of an electrical show. Would it not be an excellent plan to put on shows in the various large centers of the West in the fall of the current year, so timed in their opening as to make it possible to begin with Salt Lake City, then on the Butte, then to Seattle, then to Portland, then to San Francisco, and finally to Los Angeles? Such exhibits could well be made transferable and would greatly add in the combined effect, making possible the presenting of a show that would surpass all previous achievements of this nature. The matter is already under active discussion in California and it might well be considered by electrical men in other sections of the West. Ample time should be given in the preparation of this exhibit and it is believed that if it is fostered by local electrical organizations devoted to the betterment of the electrical industry, the undertaking can be made tremendously helpful and at the same time remunerative for those public spirited bodies that aid in its support.

Proper Illumination

The day for guess work in the matter of illumination has gone by. Every man of the industry should ask himself, "Can I give an intelligent answer to the inquiry of what constitutes proper illumination?" There is still need for education within the industry itself and the exhibits that have been put on by the California

Electrical Cooperative Campaign throughout the state of California should be taken advantage of by every member of the industry to enlighten himself on this very important subject. It is to be hoped that similar cooperative leagues will institute exhibits of this helpful nature throughout the West.

Scientifically designed illumination units unquestionably have awakened the public to more economic use of the hours of business activity. To the spreading of this idea of better illumination and its associated economic gain every member of the electrical industry should devote some of his time during the months ahead.

Phenomenal Attendance at Home Electrical

The first four days of the opening celebration at the latest "Home Electrical," Los Angeles, brought forth an attendance of over 8,000 visitors, although two of these days were rainy and uninviting. This record is gratifying, not only to the local proponents of this institution, but indeed to the industry throughout the West which has so energetically promoted the Home Electrical idea. In the Los Angeles case, twenty-five were admitted at a time and there were always from two to three abreast with a line one hundred and fifty feet deep, waiting for admittance. This particular electrical home cost something like $38,000 to build and about $30,000 for furnishing and fixtures, and truly it has proven a model of perfection. Such exhibits as this showing the real home in actual operation are powerful factors in putting over the electrical idea to the public. The West has once again given a contribution to the nation in the way of putting over the Home Electrical idea, and the California Electrical Cooperative Campaign is to be congratulated upon the success of this new undertaking.

Bringing the Mountain to Mohammed

With the increasing use of electrical appliances which has taken them out of the luxury class and made necessities of them, has come a demand for better merchandising methods. This is partly due to the keen competition offered the electrical merchant or contractor-dealer by the large well organized department store and partly to the desire of the manufacturers and jobbers to keep the retailing of electrical merchandise in the regular channels of trade. Two of the leading manufacturers of the country have instituted "better merchandising bureaus" and since it is not possible for all of their dealers to go to their headquarters and benefit by the examples of proper counter and window dressing and learn first hand the fundamentals of retailing, traveling exhibits have been devised. These exhibits consist of lectures and demonstrations conducted by experts and are held in all of the leading towns so that electrical merchants can better fit themselves to supply the needs of their communities. These shows are really a post graduate course for the man who graduated from the college of hard knocks and the contractor-dealer who does not take advantage of them deserves no sympathy if he grumbles because business is going to the bad. The future is bright for the dealer in electrical appliances provided he studies his business and applies himself to it. Opportunities in education such as are afforded by these "better merchandising shows" should not be overlooked.

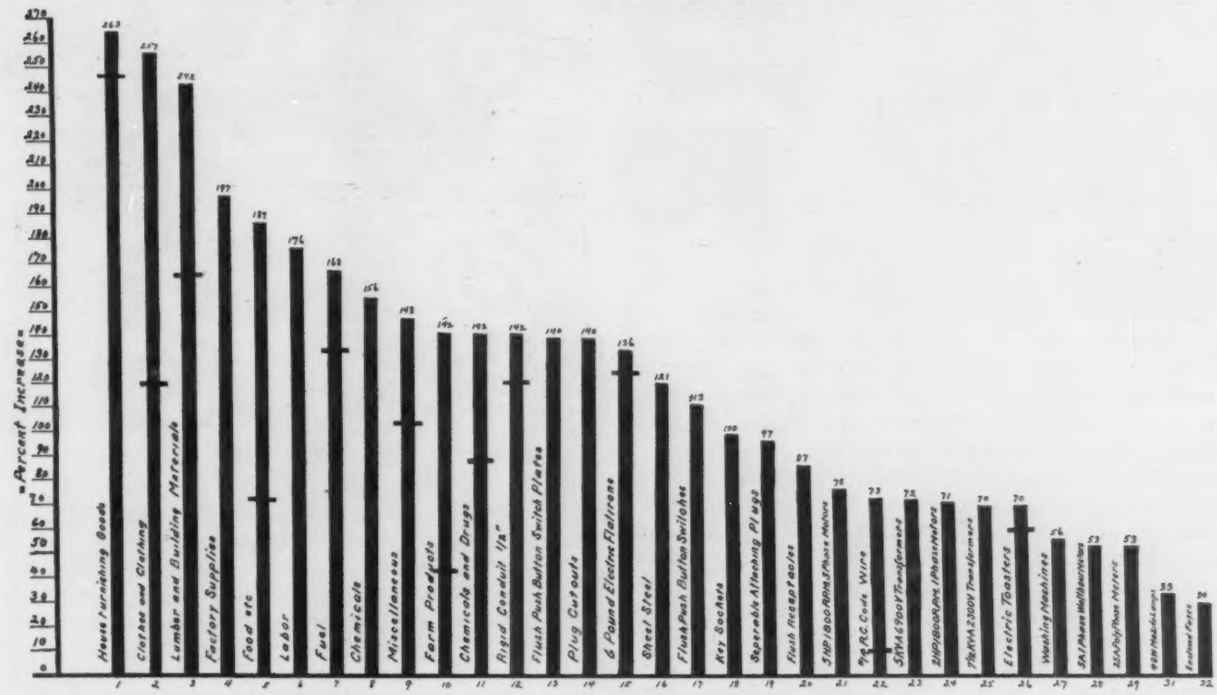
Announcement of Accounting Series

To assist in clarifying matters of profits, margins, and cost accounting in the industry, Journal of Electricity and Western Industry now makes announcement of a very forward step in its editorial policy for the coming year. Fundamentally, what is needed in the contractor-dealer's work is a clearer conception of just what cost accounting is. To this end, Journal of Electricity and Western Industry has interested the University of California, its Extension Division, and in particular Professor Henry R. Hatfield, the noted Dean of the Faculties. Beginning with this issue of Journal of Electricity and Western Industry will appear a series of fifteen articles covering the fundamentals of cost accounting and bookkeeping agreeable to the national system of standardized accounts adopted by the National Association of Electrical Contractors and Dealers some time back. This series of articles will begin with a discussion of the fundamentals in bookkeeping and accounting, and should prove most helpful for the beginner, and indeed for the clarifying of the thoughts of the more advanced contractor-dealer in the subject of accounting. Mr. Paul Kelly, research accountant, who has been making an intensive investigation among contractor-dealers of the West, is directly responsible for the work of compiling the articles, proceeding under the personal direction of Professor Hatfield.

Professor Hatfield today is known throughout the nation as one of our ablest authorities on the subject of accounting, and we believe this new activity of Journal of Electricity and Western Industry will constitute one of the most far-reaching and most helpful it has ever attempted.

It is up to the contractor-dealer to know his accounts, to know the status of his business in order that the eternal subject of margins and the cost of doing business may once and forever be disposed of in an equitable and intelligent way. Only by understanding the fundamentals involved in cost keeping and accounting can this be accomplished. Hence contractor-dealers throughout the West should at once be preparing themselves to follow this series of lectures that will appear in Journal of Electricity and Western Industry, and to take advantage of such supplementary question and answer courses based on this series of articles that will be made available by the Extension Division of the University of California throughout the current year.

The movement has the enthusiastic backing of the California Electrical Cooperative Campaign, and is endorsed by leaders in the Northwest Electric Service League as well as by the Rocky Mountain Electrical Cooperative League at Salt Lake City.



WHOLESALE PRICE INCREASES OF ELECTRICAL AND OTHER COMMODITIES OVER 1913 AND 1914

Items 1, 2, 3, 5, 7, 9, 10 and 11 are figures taken from U. S. Departmentufacturers' prices to electrical jobbers and power companies, and are based of Labor, and are based on 1913 low. Item 9 (miscellaneous) includes suchon 1914 low. Item 31, however, reached its lowest point in April, 1915, important items as cottonseed meal and oil, mill feed, manila hemp, rubber,and its present price is 48 per cent above that of 1915 low. soap, paper, lubricating oil and wood pulp.

Item 16 is taken from data secured from U. S. Steel Products Co.of Labor and present prices of electrical commodities on which price and is based on 1914 low. reductions have been quoted. No up-to-date-figures are available on items

Items 4, 6 and 8 are taken from a survey of their own business costs4, 6 and 8. There have been no price reductions on the other items which made by the American Writing Paper Co. and are based on 1913 low. are shown without horizontal lines.

Figures on electrical material represent the increases in certain man- All figures are approximate only.

Horizontal lines represent December, 1920, prices from Department

THE PRESENT PRICE SITUATION FOR ELECTRIC MANUFACTURERS

The so-called "buyers' strike," which has aroused nation-wide comment and has undoubtedly been responsible for considerable loss of sleep on the part of business men, bankers, economists and others, is due no doubt to the popular assumption founded upon newspaper publicity, that all prices are very much inflated. The sentiment that prices under present conditions must be radically reduced before purchases will be made, has been widely spread.

The assumption that all prices have been inflated is, however, untrue, as an examination of the facts will display. With this attitude of hesitancy, prospective purchasers as a rule do not differentiate between products on which there has been much profiteering, or greatly inflated prices, and those products on which price increases were comparatively moderate and hardly in proportion to the increased costs of production. It may therefore be necessary for electrical manufacturers to make some very moderate reductions in prices, thereby sacrificing profits in order to satisfy this psychological attitude on the part of the public and stimulate buying.

This hesitating attitude can undoubtedly be helped by a study of the relative price increases on electrical material compared to materials in other industries. The accompanying chart, representing a portion of the study made along this line by one manufacturing organization, shows how small has been the maximum increases in the prices of electrical commodities. Increases on electrical commodities shown on this chart are based on the very low points of 1914, at which time prices on many electrical commodities were really subnormal; in other words, below a fair price basis considering the cost of production even at that time.

Labor costs in production, manufacturing, transportation, distribution, etc., make up a very large part of the final cost to the consumer of any product and surveys in this field show increases in wages varying from 100 to over 200%. It is recognized that even with the so-called radical decreases of from 10% to 30% in certain sections, labor costs are still very high with respect to the pre-war level.

It is extremely doubtful if prices will ever reach their old low level. A study of economic history shows us that each successive cycle of expansion leaves us with a higher normal basis. It would seem, then, from a study of the chart, that prices on electrical materials are not unduly high compared to costs and increases over 1913 as shown for other commodities.

A prompt and immediate purchasing on the part of prospective purchasers, who are now hesitating awaiting lower costs, would be the immediate result if all manufacturers and wholesalers in the electrical field would equip themselves with similar charts, using information for which they can vouch, and send their salesmen out to tell this story.

EXPERIMENTS UNDERTAKEN TO DEFINE WHITE LIGHT

Experiments have recently been undertaken by the American Physical Society and the Optics Society of America, in response to numerous questions, to determine at what temperature a source of light would appear "white" under standard conditions of observation. They are the first accurate experiments of this nature ever performed.

It was determined that the theoretical temperature which a hypothetical source would have in order that its light might evoke the sensation white, the hueless sensation of brilliance recognized as neither bluish nor yellowish, would be about 5200 degrees absolute Centigrade. Practically, the light of the average noon sun at Washington evokes a sensation very closely approximating white.

The definition of "white light" naturally constitutes a very important part of the scientific foundation of colorimetry. If we consider incandescent light sources generally (including oil and gas flames; carbon and metallic filament electric lamps) we find that the light from sources at comparatively low temperatures evokes reddish or yellowish colors. As the temperature of the source increases, the color becomes paler and paler yellow and, at higher temperatures, approximates to "white." However, all artificial incandescent sources are decidedly yellow in comparison with sunlight, since it is not possible to operate an artificial source at a sufficiently high temperature to color-match sunlight.

MANY APPLICATIONS MADE BEFORE FEDERAL POWER COMMISSION

Since the creation of the Federal Power Commission, which issues licenses for the development and utilization of power on any of the navigable streams, public lands and reservations in the United States, a great many applications have been made. The location of these filings is shown on the accompanying map. A list of these filings follows:

ARIZONA

A1.....C. A. Heberlein; Cataract Canyon, Coconino County, Ariz.
A2.....E. L. Bayard; Hvalpai Indian Reservation, Colorado River, Ariz.
A3.....So. Cal. Edison Co.; Lee's Ferry, Colorado River, Ariz.

ALASKA

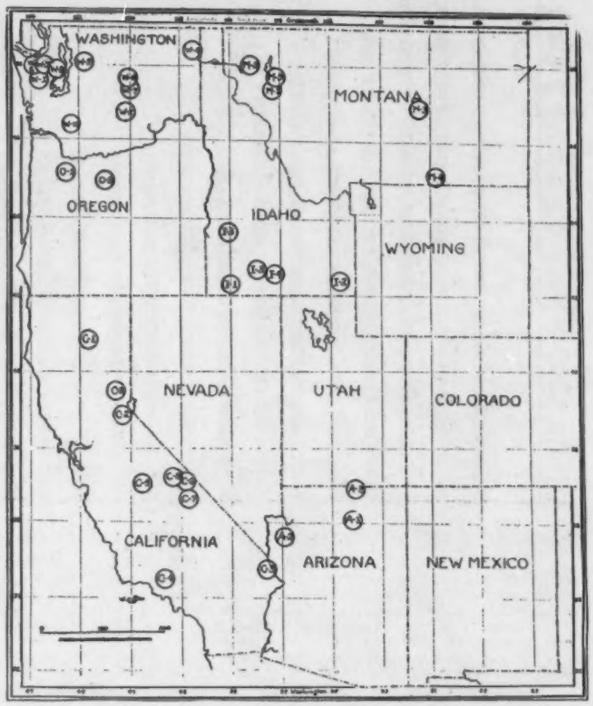
L. J. Vogter; Orchard Lake, Swan Lake, Fish Creek and Sholockum Lake, Alaska.
W. D. Grant; Critterden Creek, Mill Creek, Bradfield River, Alaska.
Alaska Endicott Mining and Milling Company; William Henry Bay, Aaska.

CALIFORNIA

C1.....Pit River Power Company; Pit River, Cal.
C2.....R. W. Hawley; Silver Creek, Eldorado County, Cal.
C3.....Beckman and Linden Corp.; Colorado River, Ariz. and California.
C4.....Sespe Light and Power Co.; Piru Creek, Cal.
C5.....H. H. Wadsworth; Middle Yuba River, near Dobbins Creek, Cal.
C6.....Southern Sierras Power Co.; Convict Creek, Cal.
C7.....Luther Hill; Sam Mill Creek, Independence, Cal.
C8.....So. Cal. Edison Co.; South Fork, San Joaquin River, Cal.
C9.....So. Cal. Edison Co.; Big Creek, Cal.

IDAHO

I1.....G. W. Spoerry; Moyie Falls on Moyie River, Idaho.
I2.....Utah Power and Light Co.; Soda Point, Lava, Narrows and Mink power sites on Bear River.
I3.....Idaho Power Co.; Upper Salmon Falls on Snake River.
I4.....Idaho Power Co.; Twin Falls on Snake River.
I5.....Moore's Creek Boulder Gold Dredging Co.; Boise; permit for transmission line.



MAP SHOWING LOCATION OF PARTIAL LIST OF FILINGS BEFORE FEDERAL POWER COMMISSION

One hundred and sixty-eight applications for preliminary permits to develop hydroelectric resources have been filed with the Federal Power Commission since its inception. The horsepower involved is 57 per cent of the estimated maximum potential water powers of the country, totaling 13,469,181.

MONTANA

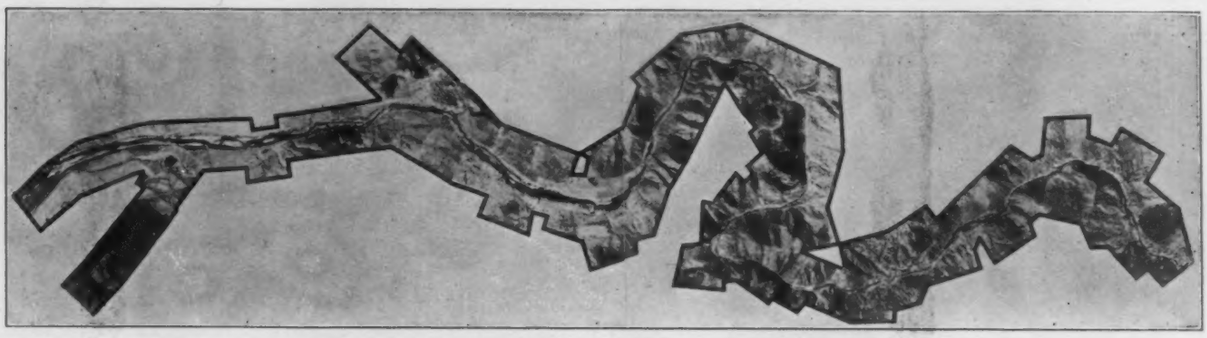
M1.....Rocky Mountain Power Co.; Flathead River below outlet of Flathead Lake, Mont.
M2.....W. P. Mills; Vermillion River, Mont.
M3..... Rock Creek Power Co.; Rock Creek, Mont.
M4.....Big Horse Canyon and Irrigation Co.; Big Horn River, Mont.
M5.....Montana Water Power and Electric Co.; South fork of Flathead River at outlet of Flathead Lake.

OREGON

O1.....Crown Willamette Paper Co.; Falls of Willamette River, West Linn, Ore.
O2.....Columbia Valley Power Co.; Deschutes River, Ore.

WASHINGTON

W1.....Alex. Polson; headwaters of Wynooche River, Olympic National Forest, and northeastern part of Grays Harbor, Wash.
W2.....Washington Irrigation and Development Co.; Priest Rapids, Columbia River, Wash.
W3.....Northwestern Power and Mfg. Co.; Lake Crescent, Elwha River, Wash.
W4.....Hugh L. Cooper; Clark Fork of Columbia River, Wash.
W5.....Sound Power Co.; Sultan River and Olney Creek, Snohomish County, Wash.
W6.....Straits Power Co.; Soldue River, Crescent Lake and Lyre River, Clallam County, Wash.
W7.....Wenatchee Commercial Club; Rock Island and Cabinet Rapids, Columbia River, Wash.
W8.....W. F. Sheffel, Wenatchee; Columbia River, Wash.
W9.....Washington Development Corp.; Dungeness River and West Fork Creek, Olympic National Forest, Wash.
W10.....Spirit Lake Ry. & Power Co.; Spirit Lake, Wash.



AIRPLANE PHOTOGRAPH OF LOWER SAN JOAQUIN RIVER

The composite photograph above which resembles some weird serpent is a "mosaic" of the lower San Joaquin river, composed of 292 individual photographs, taken in one flight for the San Joaquin Historical Society by Rex C. Starr, construction engineer for the San Joaquin Light and Power Corporation. The scale of the reproduction shown here is approximately 1 to 100,000. The original photographs are six inches square, and were taken by an automatic camera at the rate of four per minute during the flight.

HYDROELECTRIC POWER DEVELOPMENT IN NEW ZEALAND

A very comprehensive scheme for the hydroelectric development of New Zealand has been recently announced in the annual report of the Minister of Public Works. The scheme consists of a complete high-tension transmission system in both the North Island and the South Island, connecting up the different hydroelectric power centers with the many electric power board districts.

The following table gives the appropriations for the present fiscal year ending March, 1921, covering the principal Government hydroelectric power schemes now in hand, and the amount allotted to surveys and preliminary work, compared with the expenditures for these respective purposes the previous year:

Items	Appropriations, 1920-21.	Expenditures, 1919-20.
Arapuni scheme	$ 486,650	$ 28,980
Mangahao scheme	1,216,625	105,807
Horahora scheme extension	486,650	6,525
Lake Coleridge scheme	888,136	203,835
Survey and investigation	145,994	3,377
Total	$3,224,055	$348,524

There are now 71 local electric supply plants in operation in this Dominion, with a total capacity of 45,805 kilowatts, and 7 of these are proposing extensions at an early date with a capacity of 33,500 kilowatts at a total estimated cost of $7,698,803. In each case provisions are made to join up with hydroelectric current as soon as it is available.

The Government proposes only to construct the hydroelectric power stations and the main transmission lines and substations, from which the current will be sold in bulk to the local power boards for distribution to the consumers. The Government policy provides that the local organizations shall be solely responsible for the distribution of the power for private uses.

The local electric power boards are authorized to control the distribution in the different power board districts of the current that is taken in bulk from the transmission lines as arranged by the New Zealand Government. The power boards are public local bodies authorized to raise loans and provide a suitable power and lighting system for the district. There are a number of these power boards.

FEDERAL COAL AND LIVE STOCK BILLS INVOLVE DRASTIC REGULATION

Considerable interest is being shown by industrial interests throughout the country in the two bills now pending before Congress, informally known as the Calder bill, which involves regulation of the coal industry, and the Packers' bill.

The United States Chamber of Commerce has taken an active stand against both measures, pointing out that the proposed regulation of these two industries introduces a new principle in government regulation, for the first time passing beyond the bounds of recognized public utilities and opening the way for eventual federal regulation of all industry.

On the other hand, the hearing on the coal bill before the Senate committee has brought out much comment on the necessity for remedying present conditions. Geo. W. Elliott, secretary of the national committee on Gas and Electric Service, testified to the effect that public utilities, who consume annually over 50 million tons of coal, had suffered greatly during the past year, largely through breach of contract on the part of coal operators who could obtain higher prices in open markets. He did not express his opinion of the present bill.

The bill as now before the Senate Committee on Manufactures, provides for a stringent federal control of the coal industry in times of emergency (not confined to periods of war), including price fixing and a licensing of all operators, as well as control of the production, movement and distribution of coal. At all times costs, profits and other statistical data are to be filed and published for the use of consumers.

The so-called Live Stock bill which has passed the Senate and in a modified form is now before the House is even more comprehensive. It permits a voluntary registration on the part of stock concerns, granting special rights, however, to those registered in the form of assistance in securing cars and of special information. The commission appointed to supervise these licensed concerns is provided with very broad powers which include the fixing of charges and the control of business forms and practices. It is claimed by the opponents of the bill that the privileges granted to licensees enforce registration and that the powers granted permit virtual government operation of the industry.

The main buildings of the Federal Telegraph Company at Palo Alto, California. This company has a capitalization of $2,500,000 and its output finds a world-wide market. Its principal products are long distance, high power radio arc transmitting sets.

The Status of Electrical Manufacture in the West

(The West until recently has not been considered as a manufacturing center for electrical goods, but practically every form of electrical consuming device, radio receiving and transmitting sets, besides power company equipment, is now being manufactured here in the West. With cheap and dependable power, ideal weather conditions and immunity from transcontinental freight rates, electrical manufacturing has established itself permanently in this region.—The Editor.)

Ten years ago there were not more than a few hundred people in the entire West engaged in the manufacture of electrical goods. Now one western factory alone has some six hundred employes, and the total engaged in electrical manufacture runs into tens of thousands. From two or three small factories operating a decade ago, the list has grown to close on thirty thriving western plants devoted solely to the manufacture of electrical goods. In addition to these, many of the big manufacturers have established on the Pacific Coast large assembling plants which in many respects may be considered as factories.

Manufactures Varied and Extensive

The goods produced by these plants are not specialized, or limited in any sense. They include all the regular household appliances, vacuum cleaners, irons, washing machines, and heating devices, as well as electric ranges, lamps, electric signs, electric fixtures of all kinds, and testing equipment, meters, switches, and radio apparatus. The demand for radio apparatus has naturally been of very recent growth, but quite apart from this branch of production, the value of the output of electrical manufacturers in the West has tripled within the last five years. Some of the developments shown by the collected figures are so rapid as to be nothing short of phenomenal, and in every case there is a steady growth in output which is indicative of a constantly growing demand and an unusual industrial activity.

The figures given in the accompanying table were compiled from the answers to a questionnaire sent out to all the leading western manufacturers of electrical supplies, and, though incomplete, show clearly the general trend of development along this line.

Sources of Raw Material

It is noticeable that a considerable proportion of the raw material used by these factories is obtained in the West. This is significant in view of the fact that a large part of the "raw material" used in the manufacture of electrical goods is not strictly raw material, but material which has already gone through some preparatory process. This implies the presence in the West of large numbers of other types of industrial plants, and statistics show that these are being established with increasing rapidity. The advantages of the Pacific Coast as a seat of industrial activity are no longer questioned. The climate, the abundance of raw materials, and above all, the supply of cheap hydroelectric power, are fast attracting industrial plants of every type.

There is, moreover, the question of high transcontinental freight rates. These are playing no small part in fostering western manufacture, since under present conditions it is possible for a comparatively small local plant to compete successfully with a large-scale-production plant which must add to its costs the expense of having goods shipped across the continent.

Western Demand for Electrical Goods

Cheap power has another very definite effect upon the business conditions of the West in that it leads to a very large per capita consumption of electricity in the home as well as in industry, thereby creating an unusual demand for electrical appliances and other electrical manufactured products. This condition is reflected in the ready western market which the western manufacturer finds for his electrical goods, as shown by the figures in the table. On an average, over 80% of the electrical goods manufactured in the West are disposed of in western states, some firms giving 100% as the proportion of their goods marketed on the spot. And yet a comparatively small proportion of the western demand is met by western products. The call for electrical goods is far ahead of the locally manufactured supply, and increases more rapidly than new factories can be erected to meet it, in spite of the fact that both local firms and eastern concerns with western

branches are steadily taking advantage of the natural advantages of the Pacific Coast to establish manufacturing or assembling plants.

Foreign Markets for Western Manufactures

Another interesting fact brought out by the survey of Pacific Coast electrical manufacture is the extent of the foreign market. Some firms record that as much as 25% of their output goes abroad, chiefly to the Orient, though the South American market is becoming increasingly important. This condition is significant of one of the most important factors in the future industrial growth of the West—the tremendous foreign market offered by the Orient. The Pacific Coast holds the strategic position for the development of this market, and it is common knowledge that the Orient, especially China with its countless millions of population, is just now awakening—from an industrial point of view—and becoming an increasingly important customer for electrical goods. The natural outlet for western manufacture is the Orient, and all commercial activity in this region is tending toward the promotion of the pan-Pacific idea as the normal stimulus for western industrialism.

At its present rate of growth, electrical manufacture on the Pacific Coast will, in a very few years, hold a position second to none. And a territory which, by virtue of its unusual hydroelectric resources, is developing an essentially electrical community, is singularly well adapted to this particular branch of manufacturing activity.

NAME OF FIRM	CAPITALIZATION	ARTICLES MANUFACTURED	SOURCE OF RAW MATERIAL	MARKET FOR PRODUCTS	VALUE OF OUTPUT	NO. OF EMPLOYES
Colin B. Kennedy Co. San Francisco, Calif.	$ 50,000	Radio Equipment	Local and Eastern Points	No. and So. America and the Orient		10
Edison Electric Appliance Co. Ontario, Calif.		Electric Heating Appliances, Ranges, Bake Ovens, Vacuum Cleaners, Etc.	Principally Eastern Half of United States	Western States...40% Central States....20% Eastern States....15% Foreign.....25%	1904.....$ 5,000 1915..... 1,500,000 1918..... 2,000,000 1919..... 2,000,000 1920..... 3,000,000	600 (av.)
Electric Heating & Mfg. Co. Seattle, Wash.	$ 75,000	All Kinds of Electric Heating Devices	All Parts of United States	Western States...40% Central States....15% Eastern States....20% Foreign..... 25%	1915.....$ 1,200 1918..... 12,000 1919..... 20,000 1920..... 25,000	8 (av.)
Electric Products Corp. Los Angeles, Calif.	$ 100,000	Electric Signs and Stage and Theatre Lighting	Miscellaneous	Western States...95% Foreign..... 5%	1915.....$ 31,000 1918..... 55,000 1919..... 105,000 1920..... 248,000	50
J. C. English Co. Portland, Ore.	$ 90,000	Lighting Fixtures	Eastern United States	Western States..100%	1915.....$ 100,000 1918..... 175,000 1919..... 215,000 1920..... 250,000	30
Federal Telegraph Co. Palo Alto, Calif.	$2,500,000	Radio Transmitting Equipment	80% from Eastern United States			
Johnson Electric Washer Co. Oakland, Calif.	$ 75,000	Electric Washing Machines	Local and Eastern Markets	Western States...99% Foreign..... 1%	1915.....$ 31,000 1918..... 78,000 1919..... 159,000 1920..... 195,000	15
Magnavox Company Oakland, Calif.	$ 750,000	Telephones and Amplifying Devices	Pacific Coast	Western States...15% Central States....25% Eastern States....50% Foreign.....10%	1920.....$ 500,000	100
Majestic Electric Development Co. San Francisco, Calif.	$ 300,000	Electric Heaters and Heating Devices	Chiefly Local; Partly Eastern	World-wide Foreign Market Large	1915.....$ 26,000 1918..... 307,000 1919..... 772,000 1920..... 1,100,000	300 (av.)
Moorhead Laboratories San Francisco, Calif.	$1,000,000	Radio Equipment	Eastern Points	Western States....30% Central States....25% Eastern States....40% Foreign..... 5%	1918.....$ 234,000 1919..... 173,000 1920..... 202,000	85
Oakland Mazda Lamp Division of General Electric Co. Oakland, Calif.		Incandescent Electric Lamps	Local and Eastern Points	Western States...100%		500
Perfeclite Manufacturing Co. Seattle, Wash.	$ 60,000	Electric Lighting Fixtures		Western States...75% Foreign.....25%		27
Safety Electric Products Co., Inc. Los Angeles, Calif.	$ 50,000	Safety Switches, Cabinet Boxes, Conduit Boxes, Switchboards	Ohio and Pennsylvania	Western States..100%	First yr., $350,000	45
Thomas Day Co. San Francisco, Calif.	$ 300,000	Lighting Fixtures and Fixture Parts	Local and Eastern Points	Western States... Foreign.....		200
Pacific Electric Manufacturing Co. Los Angeles, Calif.		High Tension Switches, Fuses, Oil Circuit Breakers	Ohio, Delaware, California	Western States...70% Central States....15% Eastern States....10% Foreign..... 5%	1906.....$ 3,600 1915..... 42,000 1918..... 106,000 1919..... 143,000 1920..... 196,000	30
Wells Morris Manufacturing Co. San Francisco, Calif.	$ 14,300	Motor Starting Switches	Chiefly Local; Partly Eastern Points	Western States..100%	1915.....$ 15,000 1918..... 21,000 1919..... 30,000 1920..... 36,000	10
Western Electro-Mechanical Co., Inc. Oakland, Calif.		Testing Equipment, Ammeters, Rheostats, etc.	Eastern Points	Western States...45% Central States....15% Eastern.....35% Foreign..... 5%		6–15
W. Wesley Hicks San Francisco, Calif.		Electric Water Heaters and Air Heaters	Local 80%	Western States..100%		

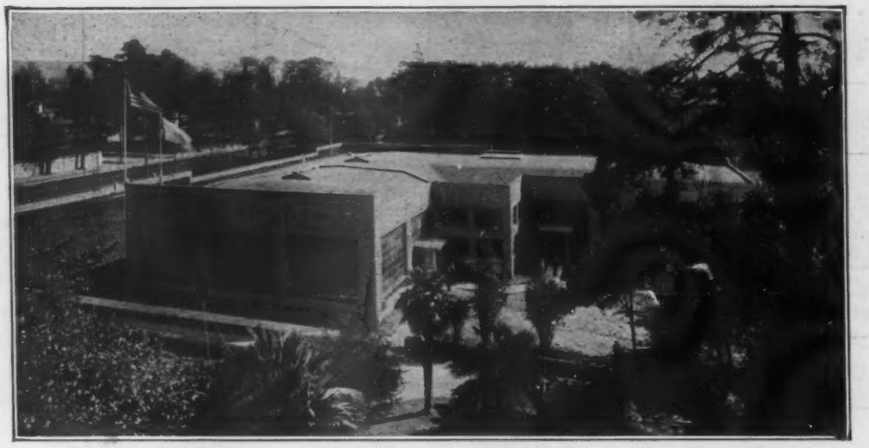
Electrical Manufacture Comes West

HIGH TENSION SWITCHES

Transmission at high voltage, which is a feature of western development, creates a ready market for the type of equipment manufactured by the Pacific Electric Manufacturing Company of San Francisco.

VACUUM TUBES

Very important research work, which has done much to perfect radio apparatus, has been conducted at the Moorhead Laboratories, San Francisco. The firm has an exceptionally large eastern market for its product.



AMPLIFYING DEVICES

In the telephone developments which have followed the introduction of radio-telegraphy few firms have done more important or more distinctive work than the Magnavox Company, whose Oakland plant is shown here. The company also maintains offices in San Francisco.

LAMPS

The Oakland Mazda Lamp Division of the General Electric Company now employs as many persons as were employed in electric manufacturing in the whole of California a decade or so ago.

ELECTRIC HEATERS

The growing demand for electric heating devices of all kinds has caused the value of the Majestic Electric Development Company's output to increase from $26,000 to $1,100,000 in five years.

FIXTURES

Factory of the Perfeclite Manufacturing Company at Seattle. The electrical home movement creates an active market for artistic fixtures in the West, where this firm places 75% of its output.

SAFETY DEVICES

The Safety Electric Products Company, Inc., located at Los Angeles, specializes in externally operated switches and switchboards. The entire output of the plant is marketed in the Western states.

RADIO RECEIVING SETS

The Colin B. Kennedy Company specializes in high grade radio receivers, and is helping to supply the demands of South America and the Orient, which have important radio stations under way. Both the local and foreign demand are large.

ELECTRIC IRONS

A section of the winding department of the Ontario Works of the Edison Electric Appliance Company, showing heater and cord departments in background. About 600 persons are employed in the plant.

RADIO TRANSMISSION SETS

The Federal Telegraph Company of Palo Alto manufactured the record radio transmission sets for the Lafayette Station in France, and caught the test messages across the intervening six thousand miles.

Standard Accounting System

BY PAUL B. KELLY

(The business and industrial world bases a tremendous part of its activities upon the science of modern accounting. The following article inaugurates an important series dealing with this vital subject, to be conducted in connection with the Extension Division of the University of California. The articles are prepared by Paul B. Kelly, under the supervision of Dr. Hatfield, Professor of Accounting and Dean of the Faculties, University of California.—The Editor.)

The electrician who starts a contractor-dealer business almost invariably is a first-class mechanic and a fellow who, by hard work and much saving, has accumulated enough money to open a shop for himself. He is enterprising, and has abundant confidence in his own ability. Time and again he has noted the prices that his boss charged for work that he did. Work for which he received $10 a day he has seen billed to the customer at $14 or $16 a day. Also, he has seen the customers charged for various items of material at rates considerably above what he knows is the wholesale price. He assumes that most of the difference is pure profit for the proprietor.

He reckons that the chief difficulty in starting up a contractor-dealer business and making the "big" money that his boss makes, lies in getting together the necessary capital, and in screwing up courage to take the plunge. He has the money and he is not lacking in nerve; so he starts business, and to get customers he cuts the "exorbitant" prices that the rest of the trade is charging. When the established dealers remonstrate with him about his tactics he invariably smiles, decides that he has them up a tree, and continues a policy which greatly damages all the dealers in the vicinity, and which will eventually ruin him if he does not "wake up" in time.

He usually does "wake up" in time, and the awakening is rather unpleasant. The profits are not what they seemed. He soon finds himself charging the accepted prices; and still the bills are hard to meet. He begins to realize that his work as a journeyman was simple in comparison to the burden of cares and responsibilities he has assumed. He learns that it takes more than a good mechanic to make money as a contractor-dealer; it takes a good mechanic and a good business man combined. He must forget that he is an electrician and hold on to the idea that he is now a business man whose chief duty is to sell material and services at a profit. Profit and not volume of business is his goal. Gradually it dawns on him that he must become a business man, get a different viewpoint, and adopt business methods.

It is hard for him to change. Implanted in him as a result of his training as a mechanic is a contempt for all things clerical. The bookkeeper is a "pinhead" who is useful in keeping customers' accounts straight, but otherwise he is parasitic. It is difficult for him to learn that he must get mathematical facts about his business, and study them to get his bearings and to determine his course. The idea clings that he can carry the business in his head. He cannot do it; in reality he is lost in a sea of petty business transactions. One move involves profit, another loss. How the general tide runs he can only guess. Sometimes a man of this sort studies and adopts business methods in solving his problems, eventually coming to guide his course by facts instead of guesses. Usually he does nothing more than to raise his prices generally as much as competition will permit. Gradually he settles into a rut in which he works hard, does a fair volume of business, but gets from his business only a fair salary, interest on his capital, and a fair profit over all.

THE ACCOUNTING SERIES

The Standard Accounting System has been devised especially to fill the needs of the contractor-dealers. The object of this series of articles is to describe in detail the manner of installing it and operating it so that the contractor-dealer who at present knows nothing about double entry bookkeeping will be able to do it himself. The course will consist of 15 articles and will deal with four main topics, taken up in the following order:

1. A description and explanation of the forms used in recording the data needed for maintaining customers' accounts and job costs, and all the other accounts used in a double entry bookkeeping system.

2. An exposition of the double entry theory of bookkeeping and a detailed explanation of the use and function of each account kept by the Standard Accounting System.

3. A description of the ruled forms which the Standard Accounting System uses for the purpose of quickly arranging and condensing the data gathered into monthly journal entries, and an explanation of the way in which these entries are entered in the ledger.

4. A description of the manner in which the two monthly statements are drawn from the ledger, and a discussion of miscellaneous difficult points.

Few of the contractor-dealers are making the money they should be making. The reason why so many contractor-dealers are not securing a fair return is because for them, one or more of the three following conditions exist:

Condition No. 1. The contractor-dealer is a good manager and produces at a minimum cost, but does not sell at a profitable figure, either because he, individually, is ignorant of the actual cost of each job, or because the trade collectively is ignorant of such costs and blindly makes prices which are too low but which he must meet.

Condition No. 2. The selling price is what the job is really worth, but the contractor-dealer does not secure a fair profit because he is a bad manager. The contractor-dealer is a bad manager who does one or both of two things:

A. If he allows his expenses to run unnecessarily high.
B. Or, if he does not employ his capital advantageously.

Condition No. 3. The contractor-dealer may not be making money because the manufacturer allows him a margin insufficient to cover cost of handling and allow a fair profit.

One, or two, or possibly all three of these conditions are operating to render his business unprofitable. The contractor-dealer probably is positive that it is not Condition No. 2 that operates to rob him of his profits. Perhaps it is not; but let him guard against being like the man who enjoyed fire-and-brimstone sermons because he thought that they

were not intended for him. Hunches and opinions are worthless. The contractor-dealer must abandon his "hit-or-miss" program and adopt business methods if he is to remain a business man.

The only way for the contractor-dealer to find his source of trouble and to stop leaks is to get the cold facts and act on them. If the facts show that his business is well managed and that the fault lies with the uninformed trade or with the manufacturer, the solution lies in collective action. If on the other hand, the facts indicate that he is a poor manager his task must begin with himself.

The Double-Entry System

The modern business man gets the cold facts needed by him for carrying on business on an intelligent basis by means of two monthly statements—the Balance Sheet, and the Monthly Summary of Operations. The nature of these two statements and their use in pointing out leaks and in disclosing conditions will be explained presently. There is no substitute for these statements. The man who thinks that he has all the facts needed by a practical man after he takes annual inventories and reckons he owns more or less than he did last year is pathetic.

A double-entry system of accounts is the most economical and accurate means of obtaining this information. There is nothing mysterious about "double entry" or miraculous in the "balances" incidental to it. "Double entry" is merely a scheme by which complete information is recorded in a manner that automatically proves the arithmetical accuracy of the record. Any person who has a good knowledge of arithmetic can learn the "double entry" method of keeping accounts. A double entry system is not expensive to install or to operate. Its installation consists chiefly in taking stock of everything owned and owed by the concern. Its operation involves very little more time than is at present spent by the dealer in keeping nondescript records. In a typical contractor-dealer establishment whose sales do not exceed $150,000 a year all necessary bookkeeping, including customers' accounts and job costs, can be done in two hours a day. It is not essential that the dealer keep the books himself; neither is it necessary, as an alternative, to employ a bookkeeper full time. Invariably the dealer will find that, by advertising his need, he can secure some person who will come into his office for an hour or two a day to do the necessary work. Perhaps in most cases it would be wiser for him to "leave the cooking to the cooks," for he is vitally concerned not with gathering the information, but with the study and use of it after it is presented in the two monthly statements.

The Standard Accounting System

The National Association of Electrical Contractor-Dealers has prepared a Standard System of Accounts especially designed to meet the needs of the typical contractor-dealer. This standard accounting system gets the information needed in the quickest, easiest way, without red tape and useless forms and work. This system gives to the dealer a more economical and accurate means of keeping customers' accounts; it methodically shows him his job costs. It provides for the two monthly statements and affords the dealer a splendid grasp of his business.

The Monthly Balance Sheet

The monthly Balance Sheet is a statement of the financial condition of a business on the last day of the month. The balance sheet is often called a Statement of Condition, a Statement of Assets and Liabilities, and similar titles.

The balance sheet is a highly condensed statement of the assets, liabilities, and net worth of the owner. It shows three things:

1. The Assets, or What you Own.
2. The Liabilities, or What you Owe.
3. Net Worth, or What you are Worth.

By net worth is meant the difference between total assets and total liabilities. It is the amount you would have left if you sold all your assets and paid all your debts. Net worth is very simply defined by saying that

Net Worth = Assets — Liabilities.

This equation or definition may be rearranged to read:

Assets = Liabilities + Net Worth.

It is in this form that a balance sheet is always presented. Look at the sample balance sheet again. On one side are listed all the assets; on the other side are listed all the liabilities and net worth accounts. The net worth accounts in the balance sheet are represented by the "Capital Stock" and the "Surplus" accounts. With a little practice the balance sheet is easily read and understood.

COMPARATIVE BALANCE SHEETS OF THE ACME ELECTRIC CO.

ASSETS	Jan 1919	Jan 1920	LIABILITIES	Jan 1919	Jan 1920
FIXED INVESTMENTS			CAPITAL STOCK	10,000	10,000
Real Estate	4000				
Furniture & Office Appliances	300	300			
Automobiles	1700	1700			
Tools	180	180			
Cash Guarantees	125	125			
CURRENT ASSETS			CURRENT LIABILITIES		
Merchandise	6000	7600	Notes Payable	3,500	2,000
Direct Job Expense Unbilled	10	15	Accounts Payable	4,440	3,900
Labor in Progress	350	500			
Accounts Receivable	4500	5900	WORKING RESERVES		
Cash	2180	3420			
Petty Cash & Cash in drawer	50	50	Reserve for Doubtful Accts. Rec.	90	116
DEFERRED ASSETS			Res. for Depr'n. on Furn. & Appliances	200	100
			Res. for Deprn. on Autos	460	704
Insurance Premium Advances	63	61	Res. for Deprn. on Tools	30	65
Taxes Paid in Advance	42	49	Res. for Deprn. on Misc.	360	515
			SURPLUS ACCOUNT	900	2780
TOTAL ASSETS	20,000	20,000	TOTAL LIABILITIES & NET WORTH	20,000	20,000

Form of Balance Sheet provided by the Standard System of Accounts. The figures for two different periods are given in parallel columns.

The balance sheet is often called a Statement of Condition because it shows the financial strength of the concern; it does this, not alone by showing its net worth, but also by pointing out the relations between different kinds of assets and different kinds of liabilities. It is important to know the nature of the assets in which a firm's wealth is invested in order to judge its debt-paying ability. Many concerns have been forced into bankruptcy despite the fact that they were doing a very profitable business, simply because they allowed their assets to get into such a form that they were completely "tied up" and were unable to pay their bills and notes when they fell due.

Refer to the balance sheet once more; notice that the assets of the Acme Electric Co. in Jan. 1920 are in much more liquid form than they were a year ago. The cash balance is much larger and the amount of accounts receivable and merchandise are also considerably increased. Money will, in the natural course of business, be soon realized from these two items. A concern that has most of its capital invested in current assets has great debt paying ability; the concern that allows its capital to become tied up in Fixed Investments from which the return is slow has poor debt paying ability. It is also important to study the relationship between Total Current Assets and Total Current Liabilities. In Jan., 1919, the current assets amounted to $13,090 while the current liabilities were $7,940, indicating a ratio of about $5 of current assets for every $3 of current debt. A year later the balance sheet shows $17,585 current assets and $6,016 current liabilities, or a ratio of almost $3 to $1. The Acme Co. in 1920 was much safer and stronger than a year before.

Parallel balance sheets for each month in the year are kept by the Standard System of Accounts. When studied for an hour each month they will give information that no amount of worrying or guessing could replace. The contractor soon learns what his normal cash balance should be; what his stock and accounts should be at different seasons of the year; it gives him the bird's-eye view he must have. If his stock of merchandise grows he investigates the cause. If it appears that his sales also are growing proportionately he is satisfied. But if his sales are no larger, the growth of his stock is an indication of unwise ordering and is a danger sign. It warns him that he is buying slow moving stocks and that items are becoming obsolete. The balance sheet also shows the profit made, by means of the increase in the surplus account.

Since the balance sheet thus reveals the condition of the business and its debt paying ability, it is one of the most important documents in establishing and maintaining credit relations with a bank. In fact, the statement of assets and liabilities which a bank requires prospective borrowers to fill out is nothing more than a balance sheet. If the credit manager of a bank or mercantile establishment is assured of the accuracy of the balance sheet he will be guided largely by what he finds there in his decision to extend or withhold the desired lines of credit.

The Summary of Operations

The second monthly statement, the Summary of Operations, is often called by such titles as "Income and Expenditures Statement," "Profit and Loss Statement," etc.

The summary of operations shows the amount of profit or loss for the month. The figure thus shown by the summary of operations checks with the increase in the net worth accounts in the balance sheet. The summary of operations, however, does much more than merely to show the amount of profit that was earned; it shows how the profit (or loss) was brought about; and this is vital information. It shows the various sources of income and the amount of each; it also shows the amount and purposes of expenditures during the month. The difference between the income and the outgo is the profit.

Under the heading of "Cost of Sales," the summary of operations shows the contractor-dealer the cost of material, labor, and direct job expenses for the month. Cost of sales embodies what are usually called direct costs; it embodies costs that are directly attributable to individual jobs or sales. There are many other items of expense or cost, such as rent and insurance, which are not directly attributable to particular jobs. These items as a whole constitute what is known as Overhead Expense. The summary of operations shows what these expenses are and the amount of each. In the example given, all the items under the two headings, "General Expenses" and

SUMMARY OF OPERATIONS of the ACME ELECTRIC CO.
For the Calendar Year 1919

OUTGO		INCOME	
Cash Discount Allowed	56.60	Sales Billed	79,417.20
Cost of Sales Billed	42,225.55	Cash Discount Earned	968.63
Frt.Exp.&Carting (Unabsorbed)	7.90		
(OVERHEAD)			
OTHER GENERAL EXPENSES			
Salaries	7,280.00		
Rent	480.00		
Light,Heat & Power	104.79		
Stationery & Office Supp.	68.65		
Telegraph & Telephone	118.94		
Postage	46.30		
Advertising	643.92		
Taxes	193.67		
Insurance	224.40		
Association Expenses	284.00		
Automobiles	544.32		
Other General Expenses	243.19		
CONTINGENCY RESERVES & DEPRECIATIONS			
Allowance for Loss on Accounts Receivable	100.00		
Allowance for Deprn. on Fur.& Appliances	72.00		
Allowance for Deprn. on Automobiles	480.00		
Allowance for Deprn. on Tools	60.00		
Allowance for Deprn. on Merchandise	300.00		
PROPRIETORSHIP ACCOUNTS			
Dividends Distributed 5000			
Balance to Surplus 1800			
TOTAL PROFIT in 1919	6,800.00		
TOTAL	80,386.03	TOTAL	80,386.03

Sample of the form of Profit and Loss Statement provided for by the Standard Accounting System.

"Contingency Reserves and Depreciation," are included in the term Overhead. It is extremely important to know what the overhead is, and what ratio overhead expenses bear to cost of sales billed. It is from this statement that the contractor-dealer learns the percentage that he must add to direct cost to cover total cost. After he gets total cost he must add another percentage for profit. It is extremely important, therefore, to know accurately what the percentage of overhead is. In a concern doing a business of $100,000 per year a mistake of 1% really means a mistake of $500 in price and in profit. The only fair way to charge customers and the only way to make a profit consistently is to know accurately the direct costs of each job and to charge each job with exactly the amount necessary to cover overhead and to yield a fair profit. The "guess" method is unjust always; it is unjust either to the customer or to the contractor-dealer, and as often to one as to

the other. Many dealers who keep no books claim to know accurately what their overhead is. Such dealers can not know it; by a "hit-or-miss" process they arrive at a percentage which will cover expenses and yield a profit for a particular year. But as soon as prices or the volume of business change they must begin guessing again.

Solving Business Problems by Accounting

Let us now turn back and review the three conditions that result in unprofitable business, and then see how the Standard Accounting System will help to determine what one or combination of these conditions exists and how it will aid in remedying them.

1. How will the Standard Accounting System determine the reasonable price of a job? The Standard Accounting System provides an extraordinarily simple way of securing the direct cost of each job. The summary of operations each month provides the dealer with the percentage which he must add to cover overhead and to obtain a fair profit. If the trade as a whole is charging less than a just price, the only solution lies in convincing the local dealers of the facts and inducing them to correct their prices.

2. How will the Standard Accounting System detect poor management and point out the leaks?

a. By means of the monthly comparative summary of operations statements, increases and decreases in expenses of various kinds will be noted at once. The fluctuations are investigated, and in a short time wastes are eliminated. These monthly statements become the chart of the manager's progress. They show him what to strike at. After a number of dealers in a vicinity adopt the Standard Accounting System they will probably exchange notes. Average percentages will become obtainable by which the contractor-dealer may check up his own statements in regard to every item of expense, and know how he compares with the average.

b. The task of making the dollar work is a little more complex and far less understood. Most dealers realize that it takes money to make money, but few of them see that money earns more money for you only when you make it work. If you tie it up uselessly in large stocks of slow-moving merchandise, or lend it to the other fellow free of charge by allowing him a long period in which to pay his bills, you are not making your money work for you. The problem of making your money work for you is one of turnover. In business you pay out money for material, labor, equipment, and expenses, and, in return, you receive a stream of income in the form of sales. Any business is comprised of a flow of wealth outward and a flow of wealth inward. By turnover is meant the rate or velocity of this flow. To increase your turnover means to accelerate this flow both outward and inward. You make a profit when the flow of wealth inward is greater than the flow outward. By increasing your rate of turnover you increase the profits earned within a given period of time.

There is a "turnover" in all assets, but a manager is chiefly concerned in the turnover of two items—merchandise, and accounts receivable.

Turnover in merchandise is measured by the number of times in a year that the average stock of merchandise is sold and replaced. To find the rate of turnover in merchandise, divide the cost of the stock of merchandise usually carried by the total cost of merchandise sold during the year. For instance, if the average stock of merchandise costs $6,000 and the cost of all merchandise sold during the year was $18,000, the rate of turnover would be 3. It is not necessary to wait a year after installing a system of accounts to get this figure approximately. You can approximate it after you secure the cost of merchandise sold for one month by assuming that the cost of merchandise sold for the year will be twelve times as great. By dividing this figure by the cost of the stock of merchandise usually carried the approximate turnover will be secured. There is no theoretical limit to the turnover rates. In grocery concerns it is about 10 times a year, while in hardware and furniture stores it is about 4. No figures on turnover in electrical contractor-dealer businesses are obtainable at present because there is a universal lack of information of this sort. However, contractor-dealers should have a turnover, it is estimated, of at least four times a year. After the Standard Accounting System is operated in a number of concerns standard rates will be easily obtained.

The problem of turnover in accounts receivable is much the same. Turnover of accounts receivable equals the payments received on account during the year divided by the average amounts of accounts receivable outstanding. Thus if $48,000 during the entire year was received in payment on accounts, and if the average amount of accounts receivable was $6,000, the turnover rate would be $48,000 divided by $6,000 or 8 times. This indicates that all accounts receivable were collected on the average every 45 days. For a concern doing business on a 30-day credit basis this would be a good turnover rate.

The rates of turnover are important indexes to the manager. If the turnover in merchandise is too low, it means that he is carrying too large a stock and is, therefore, limiting his ability to invest in other needed assets, is increasing his overhead by exposing his stock for a large period to theft and breakage, and by paying more rent, insurance, and depreciation on it. It also indicates that there are many items of stock that are obsolete and do not move at all. It indicates bad buying judgment.

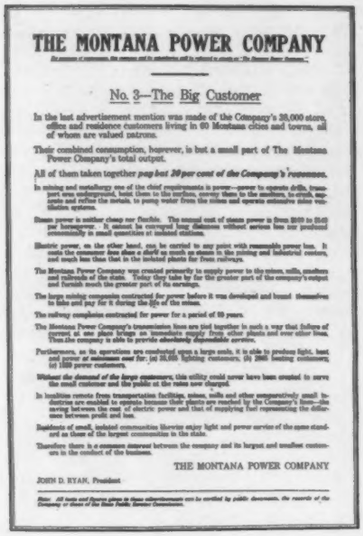
A low rate of turnover in accounts receivable is also a bad sign. It shows that customers are using the dealer's capital which is needed for the expansion of his business. It means that no systematic collection policy is pursued. It means that some of the accounts will never be paid and that many have grown stale and will be hard to collect or will be disputed.

3. How will the Standard Accounting System prove or disprove the contention of the contractor-dealers that they are receiving insufficient margins?

This is an open question. The manufacturers believe that the present margins are ample. However, they have stated that if the contractor-dealers can show real facts in support of their claims, they will increase the margins, for it is to their interest that all branches of the industry prosper. But, until they can be convinced by actual statistics they take the stand that they can guess as well as the contractor-dealers. The Standard Accounting System will easily settle this argument when a sufficient number of dealers operate it to make average figures dependable. The argument chiefly centers about the normal cost of handling and selling merchandise. This information, of course, will be easily furnished by the Standard Accounting System.

WESTERN MANUFACTURING PLANT

The value of the output of this lighting products factory located in Los Angeles, California, has increased over eight hundred per cent within the past five years.


THE MONTANA POWER COMPANY

No. 3—The Big Customer

In the last advertisement mention was made of the Company's 38,000 store, office and residence customers living in 60 Montana cities and towns, all of whom are valued patrons.

Their combined consumption, however, is but a small part of The Montana Power Company's total output.

All of them taken together *pay but 20 per cent of the Company's revenues.*

In mining and metallurgy one of the chief requirements is power—power to operate drills, transport ores underground, hoist them to the surface, convey them to the smelters, to crush, separate and refine the metals, to pump water from the mines and operate extensive mine ventilation systems.

Steam power is neither cheap nor flexible. The annual cost of steam power is from $100 to $140 per horsepower. It cannot be conveyed long distances without serious loss nor produced economically in small quantities at isolated stations.

Electric power, on the other hand, can be carried to any point with *reasonable* power loss. It costs the consumer less than a third as much as steam in the mining and industrial centers, and much less than that in the isolated plants far from railroads.

The Montana Power Company was created primarily to supply power to the mines, mills, smelters and railroads of the state. Today they take by far the greater part of the company's output and furnish much the greater part of its earnings.

The large mining companies contracted for power before it was developed and bound themselves to take and pay for it during the life of the mines.

The railway companies contracted for power for a period of 10 years.

The Montana Power Company's transmission lines are tied together in such a way that failure of current at one place brings an immediate supply from other plants and over other lines. Thus the company is able to provide *absolutely dependable service.*

Furthermore, as its operations are conducted upon a large scale, it is able to produce light, heat and power *at minimum cost for:* (a) 38,000 lighting customers; (b) 2865 heating customers; (c) 1600 power customers.

Without the demand of the large customers, this utility could never have been created to serve the small customer and the public at the rates now charged.

In localities remote from transportation facilities, mines, mills and other comparatively small industries are enabled to operate because their plants are reached by the Company's lines—the saving between the cost of electric power and that of supplying fuel representing the difference between profit and loss.

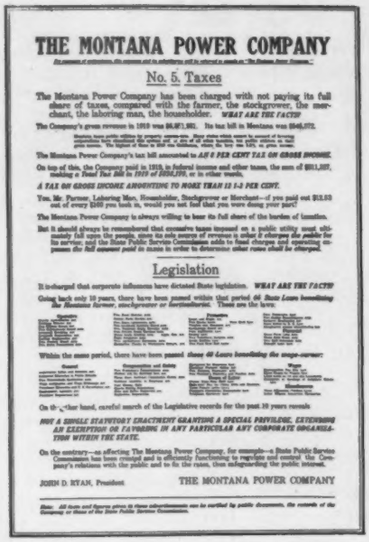
Residents of small, isolated communities likewise enjoy light and power service of the same standard as those of the largest communities in the state.

Therefore there is a common interest between the company and its largest and smallest customers in the conduct of the business.

THE MONTANA POWER COMPANY

JOHN D. RYAN, President

Note: All facts and figures given in these advertisements can be verified by public documents, the records of the Company or those of the State Public Service Commission.


THE MONTANA POWER COMPANY

No. 5. Taxes

The Montana Power Company has been charged with not paying its full share of taxes, compared with the farmer, the stockgrower, the merchant, the laboring man, the householder. *WHAT ARE THE FACTS?*

The Company's gross revenues in 1913 was $4,067,361. Its tax bill in Montana was $546,572.

Stories have got to stop. Any state which expects to attract or to keep corporations here should see to it that all of its people, by some system or other, pay their just quota. The highest of them in 1913 was Montana, where, in her 1913 tax, she paid 13.44 per cent.

The Montana Power Company's tax bill amounted to *AS 5 PER CENT TAX ON GROSS INCOME.*

On top of this, the Company paid in 1913, in federal income and other taxes, the sum of $311,337, making *a Total Tax Bill in 1913 of $858,109,* or in other words,

A TAX ON GROSS INCOME AMOUNTING TO MORE THAN 13 1-2 PER CENT.

You, Mr. Farmer, Laboring Man, Householder, Stockgrower or Merchant—if you paid out $13.53 out of every $100 you took in, would you not feel that you were doing your part?

The Montana Power Company is always willing to bear its full share of the burden of taxation.

But it should always be remembered that excessive taxes imposed on a public utility must ultimately fall upon the people, since its only source of revenue is what it charges the public for its service, and the State Public Service Commission adds to fixed charges and operating expenses *the full amount paid in taxes in order to determine what rates shall be charged.*

Legislation

It is charged that corporate influences have dictated State legislation. *WHAT ARE THE FACTS?*

Going back only 10 years, there have been passed within that period *66 State Laws benefiting the Montana farmer, stockgrower or merchant/ile.* These are the laws:

Within the same period, there have been passed *three 60 Laws benefiting the coupe-owner:*

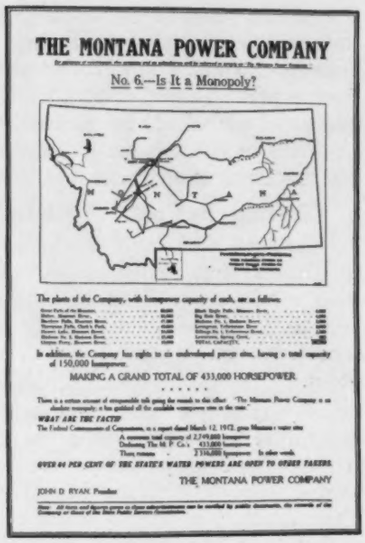
On the other hand, careful search of the Legislative records for the past 10 years reveals

NOT A SINGLE STATUTORY ENACTMENT GRANTING A SPECIAL PRIVILEGE, EXTENSION OR EXEMPTION OR FAVORING IN ANY PARTICULAR ANY CORPORATE ORGANIZATION WITHIN THE STATE.

On the contrary—as effecting The Montana Power Company, for example—a State Public Service Commission has been created and is efficiently functioning to regulate and control the Company's relations with the public and to fix the rates, thus safeguarding the public interest.

JOHN D. RYAN, President THE MONTANA POWER COMPANY

Note: All facts and figures given in these advertisements can be verified by public documents, the records of the Company or those of the State Public Service Commission.


THE MONTANA POWER COMPANY

No. 6.—Is It a Monopoly?

The plants of the Company, with horsepower capacity of each, are as follows:

In addition, the Company has rights in six undeveloped power sites, having a total capacity of 150,000 horsepower.

MAKING A GRAND TOTAL OF 433,000 HORSEPOWER

There is a certain amount of irreparable talk going the rounds to the effect The Montana Power Company is a destructive monopoly; it has grabbed all the available horsepower sites in the state.

WHAT ARE THE FACTS?

The Federal Commissioner of Corporations, in a report dated March 12, 1912, gives Montana's water sites

A maximum total capacity of 2,749,000 horsepower
Deducting The M. P. Co.'s 433,000 horsepower
There remains 2,316,000 horsepower. In other words,

OVER 84 PER CENT OF THE STATE'S WATER POWERS ARE OPEN TO OTHER USERS.

THE MONTANA POWER COMPANY

JOHN D. RYAN, President

Note: All facts and figures given in these advertisements can be verified by public documents, the records of the Company or those of the State Public Service Commission.

Three of the educational advertisements from the series run by the Montana Power Company. Each takes up one aspect of the public utility problem, and answers common criticisms with a frank and definite presentation of facts. It was found that the company can materially increase good-will by taking the public into its confidence.

A Good Will Advertising Campaign

(Advertising has developed into something more than a sales promotion scheme; it is now a form of education. The educational type of publicity is especially well adapted to the treatment of power company problems, and the general trend in this direction is well exemplified by the following account of the Montana Power Company's venture.—The Editor.)

The conception of public good will as a definite business asset is of comparatively recent origin. The growing strength of the idea is manifested by the amount of publicity which now has for its object not direct selling but the cultivation of good will between the business house and its customers. This is particularly true of the public utilities, which by virtue of the special nature of their service and the prevailing public ignorance of their needs and problems, have found this type of publicity very much worth while.

Educational Advertising

An interesting venture of this kind was recently carried through by the Montana Power Company. A series of nine educational advertisements, carefully drawn up to present the power company's position to the average non-technical customer, appeared in the columns of 191 weekly, 16 daily, and 13 monthly or semi-monthly papers, a total of 220 Montana publications. The first of these advertisements, entitled "More Light — Less Heat," set forth the object of the advertising campaign, pointing out that most suspicion and harsh judgment result from lack of information, and stating that the power company desired to enlist the interest and confidence of its consumers by complete frankness regarding its aims and its policies.

The Cost of Power Development

Advertisement number two, "Capital Requirements," outlined the construction necessary for the generation and transmission of power, the cost of this work to the company, and the extent of the territory served. Number three, "The Big Customer," explained the part played by the large consumers in making possible cheap and efficient service to small consumers.

Rates, Taxes, and Legislation

Number four dealt with the question of rates. The basis of the variation in lighting and power rates was explained, and actual figures given to show the difference in equipment and cost for large 24-hour industrial loads, and that necessitated by small lighting loads concentrated in the evening hours. Number five dealt with taxes and legislation. It was pointed out that excessive taxes imposed upon the public utility are ultimately paid by the consumer, since the Public Service Commission of Montana adds to fixed charges and operating expenses the full amount paid in taxes in order to determine what rates shall be charged. In regard to legislative matters, the advertisement stated that records of the past ten years failed to show a single statutory enactment granting special privilege to or favoring any corporate organization within the state.

Concerning Monopoly

In number six the question of monopoly was discussed. In refuting the statement that the company had "grabbed" all the available water-power sites, the advertisement stated that according to the report of the Federal Commissioner of Corporations, 1912, over 84 per cent of the state's water powers were open to other users. "Consolidation and the Common Good" was the title of the seventh advertisement, which set forth the reliability secured by

interconnected systems, the coal savings represented by the company's hydroelectric output, and the number of new or small industries which a supply of cheap power had fostered in the state.

Number eight expressed the company's endorsement of the principle of government control of water powers. Number nine was a general summary of the company's relation to the public; a statement of its position as a public servant, and an appeal for an open-minded and intelligent attitude toward its operations.

How the Campaign Was Received

An interesting feature of this campaign was the questionnaire which followed. The publishers in whose papers the series had been run were invited to answer the following questions:

1. Has the advertising of the Montana Power Company been of any, and if so of what, value to you as an editor?
2. What comment have you heard from readers?
3. Mention any criticism that occurs to you as to the necessity or desirability of this campaign, size of space used, character of the copy, or any other comment you wish to make.

The great majority of the replies were distinctly favorable, and it was notable that many editors referred to the information given by the company as entirely new to them, and as opening up aspects which they had never before considered in their discussions of the public utility question. Several expressed the opinion that the campaign should be followed up in order to be of lasting value, and that the company should make a point of keeping the public closely in touch with its activities at all times.

The following extracts from some of the letters received are characteristic of the general tone of the replies:

"Big corporations such as yours would be better understood, and, to a great extent, would avoid unjust criticism, if they would take the public into their confidence as you have done in this series of advertisements."

"You have instigated a wonderful mission, but why stop at the start? It isn't a spasmodic good will you wish to attain, but a continual good will."

Conditions indicate that this type of advertising is coming to be regarded with increasing favor by the power companies, and such as have plans along these lines will find the Montana company's experience interesting and valuable.

POINTERS ON DIRECT ADVERTISING

BY RICHARD E. SMITH

(An advertising campaign should be preceded by careful consideration of a number of vital factors. These were analyzed at a recent special meeting of members of the Los Angeles Advertising Club, and are here briefly summarized by the chief clerk of the Southern California Edison Company.—The Editor.)

Direct advertising means any form of publicity that is aimed directly at the prospective purchaser, as distinguished from general advertising which is given wide circulation with the hope that a percentage of interested people will read it. The favorite means of direct advertising are letters, catalogs, folders and circulars. These may be distributed by mail, inserted in packages, or given to the prospect by some other means.

Proper results cannot be expected unless the campaign has been carefully planned and the situation analyzed. Nine points should be considered in attacking a problem of this type. First, the plan must be weighed as to its proportions in connection with other sales effort. Is the right percentage of the advertising appropriation available for this purpose? Is the stock in shape and are the salesmen posted to handle the prospects as they are developed? Will the campaign tie in with national and local advertising on the part of manufacturers and jobbers?

Second, is the campaign aimed at the right class of people? This involves study of the mailing list to determine whether or not the person receiving the publicity is interested in the article offered and financially able to consider it. One large concern with a mailing list of two million names often devotes a week to the selection of the names for a campaign. Purchased mailing lists are apt to prove disappointing. Hand picked lists are better.

Timeliness comes third. Is the article seasonable? Is it vacation time or school time? Is the prospect apt to have spare money at this season? These and similar questions should be satisfactorily answered before the campaign is opened.

Fourth on the list is ability to buy, previously mentioned but to be considered as a separate item. If people cannot afford the article they will either refuse to respond, or, if they do, there is apt to be trouble with the collections. Careful preparation will offset these possibilities.

The fifth question is, "Is there any need for the article offered?" Many campaigns have failed because the people approached had no use for the device advertised. One would hardly think that this would apply to an electrical store, but it should be considered. Next to be noted is possible resistance to the campaign. The advertiser should be pessimistic for the moment and try to find possible objections to his article or his methods.

Another point is the motive of the buyer which will be appealed to. These motives are economy, convenience, comfort, luxury and pride. The same purchaser will have different motives at different times; for example, a business man in the market for a truck will be approached on the arguments of economy and efficiency. On the other hand, when a pleasure car is offered, the arguments will be along the lines of comfort, pride and luxury. Next to be studied are market conditions, possibilities of competition and the like.

When all these questions are answered, we come to printing methods and a complete study of the technical and mechanical considerations. If the sale is to be accomplished entirely by mail, a good proportion is eight to one; that is to say, one-eighth of the sales may be devoted to publicity. In this connection it was pointed out that an article selling for less than five dollars cannot be profitably marketed by direct advertising—unless there was a prospect of repeat orders, or for sales of similar articles.

Time should be taken for planning so that costly mistakes may be avoided; also the sales force should be thoroughly coached so that the salesman will at least know as much about the article as the prospect does when he calls to look at it.

Some Electrical Causes of Dust Explosions

BY DAVID J. PRICE

(The prevention of industrial accidents is the subject of considerable recent scientific research which is doing much to reduce the toll of life and destruction of property. The following analysis of electrical causes of dust explosions, together with suggestions for prevention, is by the engineer in charge of grain dust explosion investigations for the Bureau of Chemistry, U. S. Department of Agriculture.—The Editor.)

Dust explosions can occur in any industrial plant where flammable dusts are created during the operating process. Explosions resulting in large losses of life, foodstuffs and property have taken place in grain elevators, flour mills, cereal and feed mills, starch factories, sugar refineries, cocoa and chocolate plants, and similar industries. Disastrous explosions of "aluminum dust" and "hard rubber dust" in large factories in the Middle West have recently attracted considerable attention. Reports of explosions in wood-working establishments, paper mills, woolen mills, and spice mills have also been received. Since May, 1919, at least seven such disastrous dust explosions occurred in the United States and Canada, resulting in the loss of eighty-eight lives and property damage in excess of $7,000,000.

A starch dust explosion completely destroyed a factory in the Middle West, causing the loss of 43 lives and a property damage of $3,000,000.

Recently attention has been attracted to the large number of dust explosions and resulting fires associated with the use of electrical appliances and equipment. Some of these explosions have occurred in industrial plants where the electrical equipment had been installed in accordance with standard requirements, and where methods considered safe were being followed. Many of the explosions have occurred in modern, improved, up-to-date plants in which every advantage had been taken of the science of milling engineering, and where precautionary methods were generally adopted.

It is generally understood that dust explosions have been caused by use of matches, open flames or lanterns in dusty atmospheres. These may be considered as the simple or common causes as distinguished from the mechanical or operating causes. It now develops that electrical sparks will ignite dust, that the use of electric bulbs in dust clouds may result in an explosion if the bulb is broken, and that static electric charges may easily cause such explosions.

Similarity of Dust and Gas Explosions

In the experimental work which has been conducted by the Bureau of Chemistry, it has been found that a dust explosion behaves very much like a gas explosion. It requires a certain mixture of dust and air, together with an external source of ignition, just the same as the mixture of gas and air. Just as gas and air must be intimately mixed and in proper proportions, in the cylinder of an internal combustion engine, so these dusts must be in suspension in the air as a cloud, intimately mixed with air, and in certain proportions. Neither the mixture of gas and air nor that of dust and air will explode until it comes in contact with a flame or some other source of heat sufficient to cause it to ignite.

The explosive limits of methane gas range from 5½ to 14.5% with the highest explosive mixture at about 9.6%. The various explosive dusts apparently have similar explosion limits. It has been determined that an explosion will propagate in an atmosphere containing from 0.023 to 0.032 oz. of coal dust per cubic foot of air. Since experimental work has shown that the grain dusts are even more flammable than coal dust, it may be inferred that a less quantity of grain dust is required per cubic foot than of coal dust.

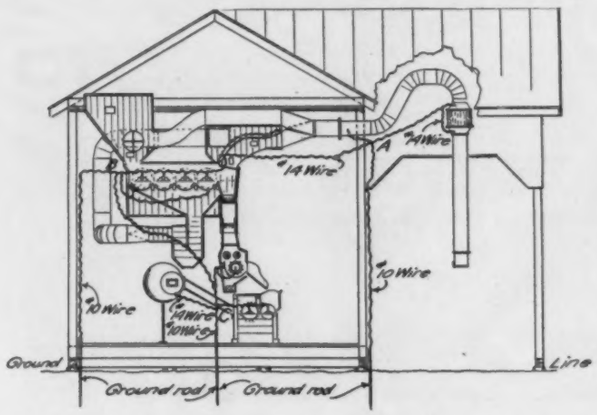
It also appears that grain dusts can be ignited more readily and propagate flame more rapidly than coal dust. Much work has been done to determine the relative ignition temperatures of the dusts, and it has been found that dextrin and starch can be ignited with a temperature as low as 540° C. and will propagate flame at from 800° to 900° C.

Early Experimental Work

The first noteworthy dust explosion on record in the United States occurred at the Washburn-Crosby Flour Mill at Minneapolis on May 2, 1878. Valuable experimental work was conducted by Professors Peck and Peckham of the University of Minnesota at that time. From the conclusions of their experiments it will be noted that although the dusts tested were readily ignited by the larger sources of heat and flames, the investigators state that under the conditions of testing it was not possible to ignite the dust by electric sparks. This fact is of special interest in view of recent developments. The following instances show the general nature of the more recent conclusions.

Dust explosions have resulted from the ignition of the dust by electric sparks from motors, switches,

blown fuses or defective electric equipment. In one instance an explosion was caused by an electric spark from a blown fuse in a plant manufacturing oil cake, resulting in the loss of 39 lives, and injuries to 101 others. The investigators concluded that "the explosion was caused by the bursting of an uncovered fuse on a temporary switchboard at the very moment when a dust cloud was formed by the breaking of a



One method for wiring cotton gin machinery in such a way that the static electricity generated by the friction of the machinery will be conducted harmlessly into the ground.

large disintegrator belt." This belt was 6 inches wide and ran at a speed of 5,000 feet per minute. From the statement of the workmen, it appeared that when the belt broke it caused a cloud of dust like a fog for a minute or two due to the dislodging of accumulations of dust on girders, machinery and plant equipment.

Electrical Bulbs Broken in Dust Clouds

Explosions have also taken place when electric bulbs have been broken in dust clouds. A recent explosion of starch dust was caused by the workmen lowering an extension light into a dusty starch bin. The dust was ignited by the breaking of the bulb in the dusty atmosphere, and the explosion propagated throughout the nearby sections of the mill.

Explosions of this nature have also followed the introduction of extension lights into various types of milling equipment where dust clouds are present. In one case the lamp bulb was accidentally dropped into a grinding machine, followed immediately by a flash of flame. In another instance the introduction of the extension into an elevator leg, where the lamp was broken, resulted in a violent explosion. Very recently, another similar explosion occurred in one of the largest grain elevators in Buffalo, when the workmen permitted an extension light to be carried with the grain stream into the elevator pit.

The possibility of dust ignition by such breaking of electric bulbs in parts of industrial plants where dust may be in suspension has been conclusively shown by these recent explosions. This development is of vital importance to industrial plants and emphasizes the necessity of adopting safety measures.

In order to determine more definitely the relation of electric lamp equipment to dust explosions and fires, the Bureau of Chemistry and the United States Grain Corporation have been cooperating in these investigations with some of the lamp manufacturing companies. Most of the experimental work has been conducted in the laboratories of the National Lamp Works at Nela Park, Cleveland. The tests have shown much regarding the conditions under which dust explosions can be produced by breaking the electric bulbs in dust clouds. They prove that this may occur irrespective of the type of the lamp. The lamps should be protected with vapor-proof equipment and be well guarded.

Dust Collecting on Electric Lamps

Fires have originated in grain elevators from dust collecting on electric lamp bulbs. If the lamps are located in dusty parts of the plant, the dust may accumulate on the globe and become heated to the point of incandescence. By falling upon combustible material on the floor a fire may result. A number of instances of this nature have been brought to the attention of the field engineers of the Bureau. This may account for some of the fires of "mysterious origin" in the large grain elevators of this country during recent months. The lamps should not be allowed to become thickly coated with dust, (1) because of the danger of fire and (2) because of the loss of illuminating value.

Static Electricity

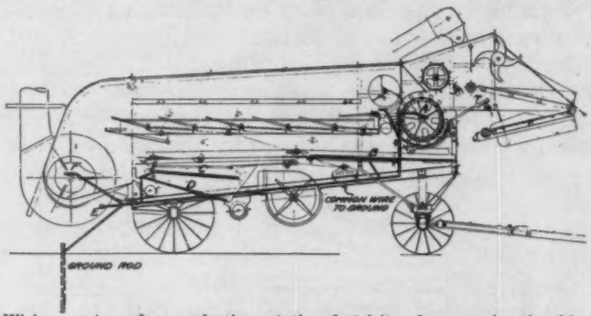
"Static electricity" has appeared prominently as a cause of a large number of dust explosions and fires. In the Pacific Northwest disastrous losses have been experienced from dust explosions in threshing machines during their operation in the harvest fields. Owing to the very favorable climatic conditions in that territory, with exceptionally low humidity and high temperature, large quantities of static electricity accumulate and are redistributed during the operation of the threshing machine. The wheat in that territory is infected with "bunt" or "stinking smut," the dust of which is very flammable. It has been found that sparks of static electricity will ignite the smut dust, resulting in explosion and fire. A complete system to conduct the static electricity to a common ground rod has been designed, and has proved effective.

A special study of frequent fires in cotton gins in the South developed much the same phenomena. The investigators found that the rubbing of cotton on the surfaces of the galvanized pipes leading to the gins produced charges of static electricity sufficient to ignite the cotton. A grounding system for the control of the static electricity has given effective results. The two distinct cases referred to are especially significant when it is considered that in a single season in the Pacific Northwest upwards of 500 explosions occurred, while in Texas and Oklahoma there were about 600 cotton gins that experienced fires in a similar period.

"Static electricity" as a cause of dust explosions in grain milling plants has appeared prominently in recent investigations. The friction of finely divided materials, with low moisture content, on wire screens or gauzes in certain types of milling equipment

(rolls and sieves particularly) has permitted static electricity to accumulate, which results in the ignition of the dust on the interior of the equipment. A similar source of ignition may be presented by high speed pulleys and belts operating in dusty atmospheres. The necessity for efficient grounding methods to prevent dust ignition from electric sparks of this nature has been clearly indicated.

Equipment affording additional safety is now being developed, which it is felt will reduce the possibility of dust explosion by the breaking of electric light bulbs, and the other electrical sources referred to in this article. The electrical causes of dust explosions, although recently determined, can be properly taken care of by safety measures. In many instances defective installations combined with bad practice have resulted in dust ignition by electrical sources. It is desired to bring the matter to the attention of the electrical engineers in the industrial plants in order that the hazard may be fully recognized and preventive methods adopted.



Wiring system for conducting static electricity from grain threshing machines. This method has proved very effective in the Northwest.

Power Company Service for the Coal Mine

(The development of natural resources such as timber and mineral deposits is the most important factor in the industrial progress of the Northwest. A source of wealth which is being greatly increased in value by electrification is the coal mine, and the extension of power company lines to this industry is resulting in the rapid progress indicated in the following article. —The Editor.)

Even in the Northwest where the abundance of hydroelectric energy has largely done away with steam installations for factory service, it would seem that the coal mining industry would be the last stronghold of the steam plant. Up to the last few years, indeed, there has been small market for the finer screenings which are a necessary element in the output of any coal mine, and some few mines have even thrown away part of their fine coal. In all mines it has been an economical proposition to burn it under boilers to produce steam or electric power for operating purposes.

The Carbonado mine, one of the first to be served by the power company, and now having a connected load of 1800 hp. There are three pumps at this mine which use a total motor drive of 415 hp.

Reduced Number of Mine Power Plants

Several elements have contributed to change this situation in the Northwest, with the result that the Puget Sound Power and Light Company has now some twenty coal mines and a briquet plant upon its lines, representing a connected load of approximately 12,565 hp. Factors in bringing about this change are the increasing demand for coke in the preparation of which fine coal may be used, the success of one of the largest producing companies of Washington in making high grade briquets from fine coal, and the general use of powdered coal. With the increased cost of extracting coal and its consequent higher market price, it is being more and more appreciated by the mine owner that in withdrawing coal from the market for mine use, the market cost, rather than the cost of mining, must be charged against the power thus generated. These considerations, combined with the reduction in investment entailed in doing away with the mine power plant, the reduction in payroll, the reliability of power company service, as well as its flexibility in case of increased demand, have all pointed the way to the use of central station service, and from 55 to 60 per cent of the coal output in Washington may now be said to come from mines which are thus served.

The Coal Resources in Washington

The significance of this fact may be judged from the importance of the coal industry in this region. The principal wealth of the state of Washington undoubtedly lies in its natural resources of timber, fish, products of the soil, and minerals. Coal is now the principal mineral produced, and though the industry is far from its ultimate development, more coal is mined in this state than in all others of the Pacific group. The annual output is now to be figured at about 4,000,000 tons, with an approximate valuation of some $17,000,000. The coal mined varies in grade from lignites to sub-bituminous and the quantity produced is sufficient to supply practically all the needs of this district, with the exception of the higher grades of hard coal which are imported from British Columbia. The Wilkeson-Carbonado field

produces the only good coking coal found on the Pacific Coast and anthracite coal has been found in commercial quantities in the northern and southwestern portions of the state.

Economies of Power Company Service

The advantages of central station service from the standpoint of convenience need hardly be pointed out—and so satisfactory has its use proved on the basis of economy alone that small or partial installa-

The grading mill at the Newcastle mine, Washington. In the right foreground can be seen the old steam plant which was abandoned when the power company's service was installed. One of the greatest benefits of the service is its freedom from interruption.

tions which have been tried out have always been increased, until most of the mines served now operate under complete electrification. The saving in labor alone during one year's time, where laborers receive from $7.50 to $18.00 per day, is an item sufficiently attractive to warrant the change over to the new service.

The decrease in the labor requirement has another aspect from the standpoint of the mine owner. In spite of high wages, with the present labor unrest there is always the danger of dissatisfaction on the part of the mine workers, which may result in a strike, or threats of one. It is obvious that the position of the management in such a controversy is greatly strengthened by the relative independence from labor which the electrified mine affords. There is, for instance, always a certain amount of dewatering to be done, varying in extent with the time of year, and it is always a possible and effective threat of the miners in case of difficulties, to withdraw the men at the pumps. An idea of what electricity has done to relieve this situation may be judged from the recently electrified Newcastle mine of the Pacific Coal Company, where formerly some eighteen men were required to operate the steam pumps. The newly installed electrical pumps could be kept in operation by two men in an emergency. This fact, with its consequent saving in labor costs, as well as the fact that the electric pumps lift the water through twice the height possible with the former installation, is but one example of the satisfaction entailed in electric operation.

Special Conditions Met by Electricity

The water to be handled varies from 500 gal. per minute in drier months to 1000 gal. per min. in the winter. Provision is made for impounding this water in the abandoned sections of the mine, in case there should be any interruption of service, but this can only serve for a very limited time. After some twenty minutes, even with the lighter flow of water, the lower levels begin to flood. As the lowest level is always the one at which work is going on, this becomes a very serious situation. One of the great advantages of central station service, indeed, is felt to be its freedom from interruptions. The Puget Sound company's system is fully tied together with two systems of transmission lines, so that the only trouble which might be anticipated would be a suspension of service while modifications on the coal company's property were carried out, for which, of course, provision would be made in advance.

Other attractive features are included in the electrification of this mine. The greater reach of the electric pumps makes it possible to utilize the water pumped from the mine direct in the washing of coal. Formerly this was pumped into the creek bed and then water was repumped from below to the grading mill. The use of an electric hoist in the transportation of supplies has also greatly simplified their handling.

Electricity is used at 2300 volts a.c. and 500 volts d.c., this latter being provided by a motor generator set used for the trolley service, both on the surface and underground. Recently the electric lights have been transferred from the d.c. to the a.c. system, which makes the illumination of the mine

Map showing location of coal mines served by the Puget Sound Power & Light Company, and indicating mines which will probably be served in the near future. The power company's coal mine load amounts to 12,565 hp.

independent of the trolley system. As the trolley of necessity is subjected to the greatest strain and consequently suffers more frequent interruptions than other mine service, the advantage of severing the lighting system from its hazards is apparent.

One of the earliest, and since its complete electrification the largest, of the installations is that at

the Carbonado mine, which has a connected load of 1800 hp. and a demand of about 1200 hp. Due to the relative locations of the workings and the river at this time, considerable pumping is done against a head of from 800 to 900 feet. There are three pumps using in all 415 hp. in motors, and six fans requiring about 90 hp. in motors. The four electric

Briquet plant of the Pacific Coast Coal Company. The success attained in making briquets from fine coal has been a factor in the introduction of power company service for the coal mine, since the fine coal was ordinarily utilized in operating a steam plant at the mine.

haulage locomotives use from 20 to 25 hp. each, the incline hoist 70 hp., the slope 250 hp. and the washer 75 hp. This in addition to motors for the incline hoist, shop motors and the lighting load. A similar installation, also of about 1800 hp. connected load, is that of the Burnett mine, located about 20 miles from Tacoma. A motor generator set consisting of 290 hp., 2200-volt motor driving a 200-kw., 440-volt generator furnishes direct current for the electric pump and washer equipment. All other apparatus is equipped with alternating current motors, lighting also being included on the a.c. system.

The Coal Mine an Attractive Load

The coal mine load, from the standpoint of the power company, is an attractive one. The period of peak comes at an off-peak time with the power company under normal conditions, the morning shift usually bringing the heaviest load at about 11 a.m. In some cases special rates are provided under an "off-peak discount" clause, of which the mines are prompt to take advantage. The use of a motor generator set for the direct current required for trolley service, provides an advantageous synchronizer and keeps the power factor at a higher point than would be possible under other conditions.

The very fact that the coal mines are totally dependent upon the central station service for their operation is a factor which tends toward good feeling. The advantage which the power companies serving agricultural districts enjoy in the keen appreciation by their customers of the vital nature of their service is similarly enjoyed in a mining district where electricity plays a no less important role. With, of course, minor complaints which are consequent upon the coordination of any two services, the coal mines are satisfied with what they are getting. They look back to the period when they suffered under the inconvenience and expense of steam operation and they see no possibility of getting along under similar conditions today. As a matter of fact, many of them are now working lower levels and enlarging their power requirements to the point where it would have been impossible to carry on the work by steam power, owing to the tremendous outlay in machinery and the extensive labor requirement which would be involved.

In spite of high prices for coal and the greater use of electrical drive in manufacturing plants, there seems to be no tendency toward a lessening of the demand. Coal is now, and will be in the immediate future, at least, the fuel for the average householder. Isolated plants, smelters, foundries and the rapidly expanding water-borne and rail-borne traffic of the Northwest, all look to coal for their fuel supply. The Puget Sound Power and Light Company is the first power company of the West to include this growing industry in its service, a foresight in building for the future for which they deserve great credit.

GIANT GRAIN ELEVATOR TO HANDLE CALIFORNIA WHEAT

A $1,000,000 grain elevator now being erected in Fruitvale, California, has been leased by the recently formed California Farm Bureau Elevator Corporation, to handle the wheat crop of the California farms. The corporation consists of farmer members of the California Farm Bureau Federation, and will finance wheat distribution, representing the farmers' holding or storage organization.

The new elevator is located in the growing industrial district adjoining Oakland. It will have a capacity of 1,200,000 bushels, and is expected to save the farmers $5,000,000 a year in sacks alone, and another $5,000,000 in labor demanded by the old sack method of handling their crops.

The president of the corporation is George Sawyear, head of the Stanislaus County Farm Bureau, with T. A. Kilkenny, and W. H. Heileman as vice-president and secretary, respectively. The corporation will work in cooperation with the California Farm Bureau Exchange, a federation of the county marketing exchanges now operating, into a state selling agency of general farm produce. Smaller elevators will be built by the county units of the Exchange, financed by the elevator corporation. The grain will be shipped in bulk from the fields, through the county elevators to the central plant, and from there will be sent direct to its eastern or European markets. This direct method of distribution is expected to solve many of the farmers' problems, and to reduce a large proportion of the expense involved in the older, more cumbersome methods. While this has been the practice in other grain centers for some time California is just starting on this new phase of the grain industry and this should be encouraged, as it is a more efficient and economical manner of handling this product. This new elevator is the second large grain elevator to be built in California and more should follow.

Plant of the Northwest Magnesite Company at Chewelah, Stevens county, Washington, 65 miles north of Spokane. This company has invested more than a million dollars in its quarries and works. Five miles of aerial tramway connect the quarry and reduction works. In the center foreground will be seen the long rotary kilns in which ferro-magnesite is produced. These works are now producing 10,000 tons monthly of ferro-magnesite.

The Outlook for the Magnesite Industry

(The magnesite industry is one of especial interest to the West on account of the fact that the only important deposits in the United States are located here. The following discussion outlines the present status of the industry and its relation to foreign production.—The Editor.)

Magnesite is an important element in the production of steel, its principal application being in the basic open hearth steel furnace which is usually lined with magnesia brick with grain magnesia spread over it to a depth of from twelve to eighteen inches. Magnesite finds further use in the manufacture of stucco, in the making of sulphite paper, as an insulating material, a toilet preparation, and in other chemical processes.

West Has Only Important Deposits

There are only two important deposits in the United States, both of them in the West. In the California deposits, however, the magnesite occurs in the amorphous state which is not the best for commercial purposes, and in consequence these deposits have not been worked to any extent since the pressure of war demand has lessened. The extensive deposits of crystalline magnesite occurring in Stevens county, Washington, about sixty miles from Spokane, are therefore the only magnesite mines now being operated in this country.

Up to the war, magnesite was obtained almost exclusively from Austria. There are limited deposits in Quebec which were held as a war emergency by American interests and several locations of some size in Manchuria and Venezuela, both of which were closed to American markets during the war period. The high prices immediately brought several companies into the field, and several plants of considerable size and importance have been erected.

Modern Equipment at Plants

There are at the present time three companies having important holdings in Washington, the developed territory of workable deposits being about equally divided between the American Mineral Production Company, the Northwest Magnesite Company of Chewelah and the Valley Magnesite, all of which have made large investments. The plants are substantially constructed and modern in every respect; living conditions at the quarries are excellent and the location is especially picturesque. The main quarry of the Northwest Magnesite Company has yielded 300,000 tons of crude magnesite up to the present time and production is proceeding on a basis of 600 tons daily.

Production at this plant has been materially helped by the 60,000-volt line run out recently from the Long Lake plant of the Washington Water Power Company, constructed in thirty days. The twenty-four hour service is utilized to light quarries for night operation, to operate air compressors, and for other processes incident to the production and handling of the mineral. Modern equipment is characteristic of all the magnesite mines, and indeed, was necessitated by the tremendous output called for during the war.

Competition with Austrian Magnesite

The future of the industry is a matter of some discussion. The market is a limited one, at the present time adequately supplied, largely from the American mines. With the re-entrance of the Austrian product into the field, it is felt by some that a tariff will be necessary to enable the American mines to hold their own. Those who contest this move, however, state that the unsettled conditions in Europe make the cost of production of Austrian magnesite on the American holdings extremely high. They claim that the American magnesite industry is safe for at least two years and that the imposition of a tariff would discourage the expansion of American enterprise into foreign fields. American interests control approximately 80 per cent of the magnesite deposits of the world, and companies interested state that the opening up of these was the determining

factor in bringing down the prohibitive price of the foreign product. It is pointed out also that the imports against which a tariff is suggested involve much more exporting for the United States.

A Future Possibility

There is another development which may become a factor in the future of the industry. This is plastic magnesite. At present the daily consumption of plastic magnesite in the United States is estimated at about 100 tons, and there is reason to believe that the demand will increase very rapidly. Plastic magnesite is not affected by any ordinary heat, does not expand or contract, and is not subject to the effects of water, air or light. These qualities and its elasticity are expected to make it increasingly popular with the building trades and all other work requiring a cement which has enduring qualities and sets speedily.

The American Mineral Production Company has been making a number of special tests during the last year, and claims that the Washington magnesite can be treated to produce the best grade of plastic magnesite. A specially designed kiln has been constructed at the company's mine for this purpose, and

View of the town of Valley, Wash., showing the hills in the background where the mines are located. Living conditions and general surroundings are excellent at the magnesite mines.

it is hoped that a large output of plastic magnesite will eventually make the plant independent of the refractory trade.

Magnetic Reflection

BY J. D. ROSS

(The study of magnetic phenomena is constantly bringing forward new theories regarding electrical energy and its relation to physical problems. The following article by the superintendent of the lighting department, City of Seattle, will no doubt be of interest to many of our readers, whether or not they agree with the conclusions.—The Editor.)

Magnetic lines varying in intensity may be reflected and refracted like light.

The following experiments are interesting not only because they show an entirely new line of phenomena, but also because they shed considerable light on the nature of the reflection of radiant energy.

The discovery of these remarkable phenomena followed from certain theories concerning the propagation and reflection of light, and particularly from the thought that reflection takes place by an intermediate transformation of energy at the point of reflection. The incident light beam changes to an electric current at the point of contact with the mirror and is absorbed. This current then throws its energy out as the reflected beam.

We know that light is electromagnetic. Faraday, Maxwell, Hertz and others have shown us the intimate connection of light and other electromagnetic phenomena. A short description is given below of some of the experiments developed by the writer in an attempt to solve the problem of the nature of reflection and to get a better physical conception of a light wave.

Reflection at 60 Cycles

A special transformer was designed using a laminated 2-inch by 2-inch cross section and designed for 50,000 lines to the square inch. The primary current was limited to 3½ kw. Instead of the ordinary secondary coil a heavy copper or aluminum ring was used. It then became a short circuited secondary of one turn. This ring had a 6-inch opening to allow it to tilt on the core at any angle desired, and weighed 4 pounds when made of aluminum. Good results, however, may be obtained with a lighter ring. When the current is turned on we know that the ampere turns in this ring are practically the same as in our primary coil, as we also know that the current circulates once in the ring for each half cycle or alternation, so it is a simple matter to design our ring for any loss that we desire. If we limit the loss to 5% of the received energy then this amount will be lost as heat and the 95% might be produced steadily in some other form. The current induced in the ring becomes the seat of new lines of force opposed in phase to the lines from the primary. This phenomena is well known as inductive interference, and through its action the transference of energy from primary to secondary is regulated.

The writer finds that if the ring is tilted at 45° to the laminated core it encircles, a normal magnetic field is projected into space in the same way as if the lines in the core were sent out as a reflected beam from the ring acting as a mirror. Being a normal magnetic field it obeys Oersted's law. Its general direction, however, obeys the law of reflection of light. Leakage lines of course appear, their number varying according to the design of the core and the distance of the ring from the primary, but they are not the cause of the phenomena.

The projected field may be mapped quite easily by using a small coil and milliammeter. An exploring coil of 300 turns of No. 16 magnet wire with 6-inch opening and carrying a small flashlight battery lamp

may be used to study these experiments. The lamp may be lighted a foot and a half to two feet away. The reflecting ring may be replaced with a short circuited coil of many turns with the same results. Several lamps may be placed around the transformer in a circle and lighted successively by tilting the ring toward each in succession. The apparatus described above is shown in Fig. 1.

The action of the magnetic lines can be better seen by using a straight bar magnet of similar design and about 14 in. long. It is best fastened

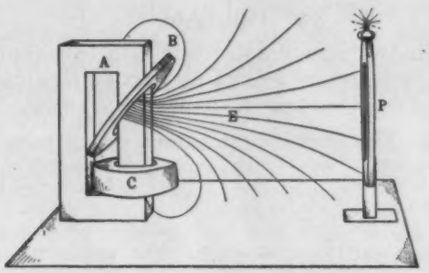


Fig. 1. Reflection of lines from a 60-cycle transformer. There is a similar flux on the other side of the ring, the path of which is modified by the presence of the iron core and by leakage flux. A—Laminated steel core. B—Ring mirror. C—Exciting coil. P—Exploring coil and lamp. E—Magnetic wave.

vertically on a board with the exciting coil on the lower end. The same ring may be used over the core, or a solid sheet of metal may be used above the core to direct the magnetic lines. The lamp of course may now be lighted by ordinary induction anywhere within a certain radius of the magnet pole, for unlike the closed core transformer, where practically all the lines travel in the iron, we now have the whole space surrounding the magnet permeated with magnetic energy. We must therefore move our exploring coil and lamp further out from the magnet to a region where the lamp will not light, say about 18 in. Four exploring coils and lamps facing the magnet and set in a circle 90° apart as explained above give a very striking effect as each is lighted in turn by tilting the ring towards each at the reflecting angle, assuming the magnetic lines in the iron as the incident beam and the ring as reflector.

When a reflector is used above the magnet it acts of course on diverging curved lines closing on the two magnet poles. This fact allows us to light our lamp quite well by using a sheet of No. 12 copper bent into a parabola and placed vertically, close to the upper half of the magnet.

Reflection at Higher Frequency

Sixty cycle reflection causes considerable heat, for all the energy reflected must exist as an electric current or short circuit in the reflector the moment before. The losses of reflection being Ohmic loss will vary with the resistance of the metal of the reflector and also with the frequency used. This suggests copper as the metal to use though at high frequency the difference is scarcely noticeable. The frequency can be quite high and still allow the use of an exploring lamp. A wave as short as 500 ft. gives splendid results. In the case of 60-cycle impulses in space at the speed of light part of each cycle or wave will be 3100 miles long. A 500-ft. wave therefore is much more easily handled and with lighter apparatus. It gives the same results.

An excellent outfit consists of a condenser of three square feet area of each surface using common glass and charged at 20,000 volts, discharging through a spark gap in series with a 10-inch diameter copper band. This band now becomes a solenoid of one turn and sends out a powerful magnetic field of high frequency. The exploring coil may consist of a similar band and small flashlight lamp.

Reflectors may be made of metal sheets or wire loops as with 60 cycles. The reflection as before is the distortion or turning back of curved magnetic lines. Since the thickness of a reflector may be less as the frequency rises, the silvering of a common glass mirror is thick enough, and we have the remarkable phenomena of the lighting of a lamp by reflection from a common looking glass.

Reflecting Tubes

Keeping in mind the idea that a magnetic line cannot pierce a closed circuit without absorption as electric current and subsequent reflection as new lines of force we may design reflecting tubes, much resembling speaking tubes for sound waves. Convenient tubes may be made up to 20 ft. length or more, and about 10-in. diameter. They may be made of any sheet metal or wire netting, up to 10-in. mesh or greater. Common iron or copper window screening is excellent. The wires of course must not be painted or enameled but must be in electric contact. The tubes must not be a closed circuit but must have their edges lapped preferably 6 in. or 8 in. and insulated from contact. The radiating band may be placed before one end of the tube or slipped over it and well insulated from it. The exploring band may

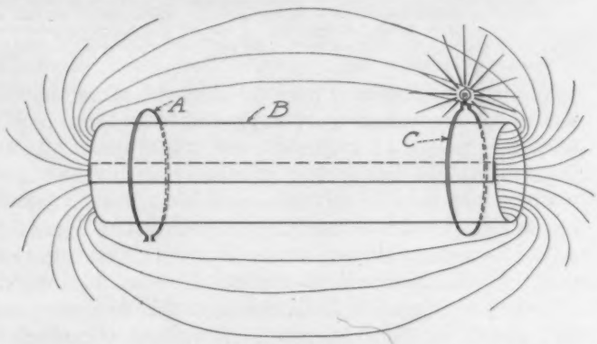


Fig. 2. Reflecting tube. A—Radiator band. B—Metal sheet or netting tube. C—Exploring band.

also be in front of the other end or may be slipped along the tube if well insulated.

The ether of space is a reality. It may consist of electrons or electromagnetic energy for matter also consists of these, but space is filled with something. Some of these experiments may be better visualized and the apparatus better designed by thinking of magnetic flux at these lower frequencies as consisting tc a certain extent of a flow analogous

to a liquid, the reflecting tube then becomes a conducting tube and the magnet or solenoid is analogous to a pump with its two poles forming areas of high and low pressure. Magnetic reluctance is then analogous to back pressure of a fluid but without loss in space.

With this analogy it is seen why the edges of the tube must have a considerable lap to prevent leakage. Otherwise a 6-inch exploring band and lamp inside the tube shows dim close to the lap and brighter opposite it. Of course there may be other explanations for this phenomena but the analogy is of considerable assistance in designing apparatus.

Lateral Component of Magnetic Line

A bar of iron suddenly magnetized sends out magnetic flux which is spoken of as closed magnetic lines. Since these lines go out into all space they

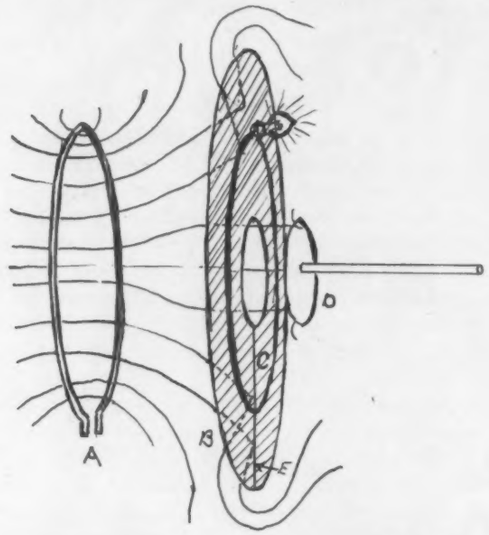


Fig. 3. Showing existence of a lateral component to the magnetic line. A—10-inch radiator band. B—16-inch annular metal sheet slit at E. C—Exploring band, insulated from B. D—6-inch disc to reflect magnetic lines back through 6-inch hole in B. E—Slot to open circuit of ring B.

take time to close and may be thought of as thrusts which for convenience are supposed to go from North to South pole. In a closed core transformer at low saturation the lines stay within the iron core and we may not be able to find any flux in the surrounding space, yet a wire ring surrounding the core, but a foot away can absorb all the energy. The question is what is the component of the magnetic wave which connects to magnetic lines through this foot of space and allows all their energy to pour into the electric circuit? Further than this the iron core may be wrapped in a copper insulated spiral sheet or the wire in which the current is induced may be drawn into a heavy copper conduit with little difference in the results though much thinner copper will reflect the magnetic line. The fact that a magnetic line need not touch a wire to induce a current is proven by the apparatus shown in Fig. 3. A 16-inch disc is placed concentrically between the radiating and exploring bands with the exploring band tight against the 16-inch disc. The lamp as stated above does not light. A 16-inch disc is cut from the center and the lamp of course still remains dark. The 16-inch disc is now slit on one side to make an open circuit and allow magnetic flux to flow through the 6-inch opening. The lamp now lights, but if the 6-inch disc is moved toward the opening from which it was cut so as to fill it, the lamp gradually dims and goes out when the opening is closed, even though there be no contact. The pencil of rays through the opening lights the lamp though it is in a shadow behind the annular copper sheet. If the 16-inch ring only is now removed the lamp lights up showing that it made the shadow.

Conclusions

The writer will not attempt in this short article to compare to any extent magnetic phenomena with those of light except to suggest two conclusions.

(1) That reflection of radiant energy takes place by the inducing of an electric current in the reflector, which current sends out new lines of force, the reflected beam.

(2) That a vibrating or intermittent magnetic line can be a wave of light with the direction of propagation of magnetism and light identical. The writer thinks of the magnetic line, for instance about a wire, as having a direction or tending to rotation about the wire as generally supposed. If an electric charge moves along a conductor it sends out electrostatic or voltage lines in space from the front to the rear of the moving charge i. e. from the area of high pressure or voltage to the area of low pressure. These lines of flow will thus form rotating curves or discs, the planes of which pass through the axis of the conductor. A line joining all their centers at any instant will be a circle around the wire. This circle is what we ordinarily define as a magnetic line. We now think of an expanding ring tending to turn inside out and at the same time tending to revolve on the wire as a center. This amounts to projecting circular voltage strains or currents along a line tangent to the wire i. e. a magnetic line is a circularly polarized light wave. It will be noticed that under this theory a circle drawn around the wire to represent a magnetic line would still have its generally recognized characteristics of intensity and direction.

As these experiments were developed the writer concluded that the speed of magnetic lines in iron was either exceedingly great or exceedingly small and inclined to the former belief. However, after applying Maxwell's formula for the speed of light, the writer is convinced that the speed of magnetic lines in iron is exceedingly small compared with their speed in free space.

A NEW SOURCE OF PAPER PULP

The possibility of using southern pine and red gum for the production of high-grade book and magazine paper has been demonstrated in recent trials at the U. S. Forest Products Laboratory, Madison, Wis. Book paper requires for its manufacture two kinds of woods—a long-fibered wood, such as spruce, to impart strength, and some short-fibered hardwood to give the formation, finish, opacity, and other printing qualities. The southern pines are long-fibered woods, excellently suited for the manufacture of wrapping paper and fiber board, but their pitch content and the difficulty of bleaching them have heretofore been obstacles in the way of their use for white paper. These obstacles, it has been shown, can be overcome in a large measure by the proper cooking conditions and improved bleaching methods.

The History of Electrical Regulation in Oregon

(The development of electrical codes, including wiring rules and lighting standards, is an interesting indication of the course of development in the electrical industry of the community. The following article outlines the history of these activities in the state of Oregon.—The Editor.)

The electrical code for Portland was originally passed by the city council about 1910, because of an insistent demand upon the part of the electrical interests of the community for the enforcement of uniform requirements relative to interior electrical wiring and installation of equipment. In addition the public was entitled to better protection than it was getting. The National Electric Code was excellent and the underwriters enforced it in all the larger installations which came under their jurisdiction. They had no police power, however, and their only recourse in case an owner refused to comply with the code was to raise the insurance rate on that particular building. The owner could, and often did, refuse to take out insurance in a "Board" company, and there was thereafter nothing to compel him to install his electrical work properly. His property then became a menace, not only to himself but to his neighbors as well, thus creating a condition which could not be permitted to continue. After many revisions the present city electrical code, which became effective December 20, 1920, and which is one of the most complete and satisfactory codes in the country, has been developed.

Beginnings of the Electrical Code in Portland

On June 22, 1910, the city council passed a building code ordinance which included a section providing for the establishment of a Division of Electricity, and another section which provided that inspection should be in accordance with the National Electrical Code. On July 7, 1912, the council passed an amended measure which provided for the bonding of electrical contractors, established a system of permit fees and provided for the issuance of permits and certificates of inspection, in addition to a set of general rules governing the proper installation of electrical work. A few months' inspection work under the amended code soon showed the necessity for more definite rules regarding proper installations, and accordingly early in 1913 the Chief Electrical Inspector issued a call to the various electrical interests inviting them to send representatives to a meeting for the purpose of revising the electrical ordinance. The following organizations sent representatives to this meeting: Building Department, City Hall; Underwriters' Equitable Rating Bureau; Electrical Wiring Contractors; Industrial Brotherhood of Electrical Workers; Electrical Fixture Contractors; Architects, and Central Stations.

A Fresh Start

At a later date when signal systems were under consideration, the telephone and telegraph companies were also invited to send representatives. After a number of meetings had been held, the city attorney announced that he would refuse to lend his support to any further amendments to the present ordinance but would gladly support a new ordinance which would repeal all existing ordinances along this line. The general committee thereupon appointed a subcommittee to prepare a new code for presentation to the council. The sub-committee prepared a complete set of rules covering electrical installations, based primarily upon the National Electrical Code but embodying also a number of special rules which seemed desirable for local conditions. This report also recommended the establishment of a board of appeal for the handling of cases in which the ruling of the inspector or the wording of the code made manifestly unjust requirements. In March, 1915, the council passed the ordinance and Portland thus had for the first time the real electrical code, which was not a part of any other code or ordinance. The present revision of the code, which became effective December 20, 1920, is considerably changed in arrangement, but the essential features of the code remain practically the same as the 1915 code.

The city of Portland believes that life risk should also be included, and some of the provisions of the local code which differ from the National Electrical Code are due to the inclusion of life risk requirements. This code applies everywhere within the corporate limits of the city of Portland. It is enforced by the Building Department of the city through its inspectors in the Electrical Division. These inspectors virtually have police power in that the ordinance establishing the Electrical Division also provides for a penalty of fine and imprisonment for any violation of the code.

State Rules Governing Wiring Installations

The rules covering the installation of wires and electrical equipment for the state of Oregon will be hereafter referred to as the "State Electrical Code." This code grew out of very similar conditions existing throughout the state, particularly in many smaller cities which for one reason or another did not maintain regular electrical inspection departments, as called for the establishment of an electrical code in the city of Portland, Oregon. At about this time the U. S. Bureau of Standards had prepared a combination safety and fire risk code for interior electrical installations which was based largely upon the National Electrical Code but also including necessary safety precautions which were intended to prevent personal injury accidents.

The 1919 legislature of the state of Oregon provided that the combined safety and fire risk code proposed by the U. S. Bureau of Standards should be the rules under which electrical work shall be installed in the state of Oregon.

The State Electrical Code is applied within the boundaries of the state, except within the corporate limits of incorporated cities and towns which by

ordinance or building code prescribe the method of installing electrical wires and equipment. This code is enforced by the State Bureau of Labor which is supported in its enforcement by a penalty clause in the act establishing the code, which provides for both fine and imprisonment for any violation of the provisions of the code.

Industrial Lighting Code of Oregon

The State code governing industrial lighting in places of employment, including factories, mills, offices and other work places, otherwise referred to as the "Industrial Lighting Code," was established by the 1919 legislature of the state of Oregon.

A very careful analysis of over 90,000 accidents which occurred during 1910 showed that approximately 24 per cent were due, either directly or indirectly, to improper lighting. Mr. R. E. Simpson, engineer for the Travelers' Insurance Company, estimates that improper lighting in 1918 was responsible for a total of 180,000,000 days of lost time, which is equivalent to the loss of the services of 600,000 men for a full year of 300 working days. In 1915 the Illuminating Engineering Society had prepared an industrial lighting code designed to require lighting conditions which would eliminate accidents due to that cause. Several states had adopted lighting codes based upon the one prepared by the Illuminating Engineering Society, and the Advisory Committee of the Council for National Defense, through its lighting division, began early in 1918 to endeavor to have every state in the Union adopt a similar code. Oregon responded at once. In accordance with a provision of Oregon's legislative act of 1919 the Commissioner of the Bureau of Labor appointed a lighting committee of three persons. This commission recommended the establishment of a certain schedule of minimum lighting values and of such other rules as were necessary to determine definitely what should constitute compliance with the provisions of the act. The Labor Commissioner adopted these recommendations, published them, and they became effective thirty days thereafter, i.e., about the first of August, 1919.

The Oregon State Industrial Lighting Code is based fundamentally upon the recommendations made by the Industrial Lighting Committee of the Illuminating Engineering Society, and it is enforced by the State Bureau of Labor.

Changes in the Industrial Lighting Code may be made by the Commissioner of the Bureau of Labor upon recommendations to him by the Lighting Commission that such changes are advisable. The code has been in operation only about eighteen months but has proved very satisfactory during that time.

Exploring Routes for Western Air Traffic

(The problems encountered in long-distance airplane flights have now more than a war-time interest. With the entry of the Airplane into the commercial field, discussion of weather conditions, landing places, flying time, and other factors such as those brought out in the diary extracts below, are of increasing popular importance.—The Editor.)

A one-day flight from Camp Lewis, Wash., to San Diego, Cal., by Major Albert D. Smith, besides being a notable accomplishment, brought out a number of features of aviation which are particularly interesting in view of the increasing use of airplanes for other than war purposes. Extracts from Major Smith's diary of the trip follow.

Plane used was the D.H.4, which had been remodeled by the Boeing Airplane Co. into what is known as the D.H. 4 B type, being equipped with the standard eighty-eight gallon gasoline tanks and eight gallons of oil. A decided nose-heaviness in landings had been anticipated, due to change in position of gasoline tank, but this was not found to be the case.

Landscape Obscured by Fog

Take-off was made at Camp Lewis, Wash., 5:50 a.m., while it was still quite dark. The guard had been instructed that in the event I was heard returning they were to start a large fire on the field with gasoline, supply of which was left available. Mt. Rainier could be seen well to the east against the sky-line; within a few minutes Mt. St. Helens could also be located to the southeast. It was now 6:30 a.m., altitude 8,000 ft., visibility extremely poor due to the low fog which covered all valleys, lakes and streams, only land showing was ridges and these all appeared alike, so was unable to get exact location.

Was gradually passing out of the fog area and could now pick up railroads and rivers, but nothing appeared familiar. Well to my left I located a large dome, protruding through a patch of fog. This proved to be the large copper dome on the Capitol Building at Salem, Ore. This explained my inability to locate landmarks, as I was well down into Oregon when I thought I was still in Washington. The Columbia river had been covered with a blanket of fog and that was one landmark which I had expected to pick up. After circling for several minutes trying to locate an opening which would permit me to get through, I very reluctantly—due to the fact that supplies and breakfast awaited me there—returned to Albany and landed at 8:30 a.m., having previously passed this point at 7:15 a.m.

At Albany considerable time was lost in obtaining supplies, and take-off was made at 9:45 a.m. The northeastern wind was still blowing and if this continued, which was not probable after crossing the Siskiyou Mountains, I should make Red Bluff, Cal., which was the next scheduled stop, in about three hours; however, I arranged two emergency oil tanks holding one gallon each, these being fastened on outside of fuselage and drained directly into filler tubes of oil tanks, wooden plugs being adjusted so they could be removed by pulling on a long wire. These plugs were removed after having been in the air two hours, this giving me two gallons oil additional. Landing was made at Red Bluff, Cal., 12:42 noon. Only six gallons of oil was consumed on this jump, so the auxiliary oil tanks were a needless measure.

Landing was made at San Francisco 2:40 p.m., this being the fastest lap on the entire trip, as the shortest air line is 170 miles.

Flying by Starlight

Took off San Francisco 3:30 p.m., and taking a true 135-degree course, reaching an altitude of 5,000 ft., landing was made at Bakersfield, Cal., 5:45 p.m. It was fast growing dark, but a clear sky. I knew the moon would be visible shortly after 8:00 p.m. and this was nearly a full moon. The Officer in Charge, Rockwell Field, San Diego, was communicated with and instructed to build two large fires with gasoline, three hundred feet apart, in front of No. 3 hangar; these were to be lighted as soon as they heard the motor.

Take-off was made at Bakersfield, Cal., 6:45 p.m., and it had grown so dark by this time that I could not see more than twenty yards. Guards were placed along the field to prevent anyone getting in the way. Striking out immediately without circling for altitude, as I would not have attempted

a landing in the field from which I had just taken off, I climbed rapidly until an altitude of 10,000 ft. had been reached, which I knew was sufficient clearance for any mountain peak between there and my destination. Taking a true 165-degree course, my motor functioning perfectly, stars shining bright, I was glad that I had decided to make the two hundred twenty mile hop in the darkness. I had provided myself with a flash-light, so had no trouble in reading my map, as cities and small towns could be seen much farther at night than in daylight. Directly ahead the sky was growing red and I was certain this was the moon coming up. It was now 8:00 p.m. and I was slightly in doubt as to the exact minute the moon should appear. My first thought was that my compass was not functioning properly, for if this was the moon I must be going nearly due east. Holding on my course for a few minutes I passed over the Santa Monica Mountains, and there directly under me was Santa Monica, Venice and Hollywood, with Los Angeles to my left a few miles. The glare from the electric lights of these cities was an exact reproduction of a rising moon.

Making a Landing at Night

When I was within ten miles of Rockwell Field, the lights of San Diego and Coronado appeared through an opening in the fog. I could see the gasoline flares touched off as I arrived over North Island, and I lost no time in getting through the fog while there was an opening. Landing was made at 8:52 p.m. without difficulty, as the gasoline flares illuminated a large area; also the smoke gave me the wind direction.

At no time, except in the take-off, was motor run above 1550 r.p.m., my high speed being due entirely to a strong "tail wind" practically the entire distance.

An airplane tour of the northeastern forest area made by Major Smith throws considerable light on the type of conditions encountered in flying over large and varied areas, with uncertain landing places.

The plane used was DeHaviland 4, regular equipment, with the exception of an auxiliary oil tank, six gallon capacity, which was installed beneath motor and giving a total of fifteen gallons of oil; gasoline tank having a ninety-two gallon capacity. It was found with this fuel supply that a flight of five hours could be made, running motor at 1450 to 1500 r.p.m., this being at the rate of about 100 m.p.h.

Equipment for a Long Flight

Following spare parts and tools were carried in fuselage in rear cockpit:

One battery; two complete wheels; six doz. spark plugs; one Liberty repair kit; one each, blow torch and soldering iron; three rolls tire tape; one pint shellac; one quart fabric dope; six yards fabric; canvas motor, propeller and cock-pit covers; two hundred ft. ½-in. rope; eight burlap sacks.

The two last-named articles were used to secure the plane at night, it being found that by swinging a few sacks of rock or dirt beneath the wings and stabilizer, and by placing the plane tail into the wind, it would ride through an extremely heavy wind, much better than where staked down solid, as the continued movement of plane will loosen stakes in a comparatively short time. In fastening plane as outlined, it is necessary to tie control stick forward and ailerons so they will not flap. Wheels were carried inside rear cock-pit, this being possible only by letting air from tires. Air pump being included in list of supplies.

Start was made from Eugene, Oregon, October 5, 1919, 4:14 p.m., landing in Portland, Ore., 6:50 p.m. Alt. 7000 ft.—clear.

At Spokane the flier was delayed a day by bad weather. Resuming the journey with the intention of reaching Missoula, Mont., he was again delayed:

Cold Weather Troubles

Practically no landing fields will be found between Camp Lewis and Wenatchee, this being a wooded area on the west of the Cascades, with small cultivated farms or orchards scattered throughout. Through the Cascades, along this route, no safe landing fields will be found. From the air, the places I would select for a landing would be on the mountain sides on the large areas covered with shell rock. These areas are quite large and are surprisingly smooth, being from 15 to 60° slope, which of course would necessitate a very fast landing, up hill.

Due to extremely cold weather was forced to land at Coeur d'Alene, Idaho, to cover portion of radiator, it being so cold that motor would not run warm enough even with shutters entirely closed.

After leaving Coeur d'Alene I realized that bad weather would be encountered through the mountains, as west-bound trains were coming out white with snow and clouds were hanging very low. Encountered first snow in vicinity of Wallace, and this continued practically entire trip, ranging from light shifts to blinding. The radiator had been throwing water, due to having lost the cap shortly after leaving Coeur d'Alene, and this had frozen on the center section wires, forming a layer of ice about one inch diameter. Alt. 6000 ft.—snowing.

From Missoula, Mont., the course was by way of Helena, Butte, Norris and Bozeman, landings being made at each place. This part of the flight, which included various conferences with forest authorities, and delays by snow, occupied four days. From Bozeman the flight was over Yellowstone Park, a landing being made at Cody, Wyoming.

Scarcity of Suitable Landing Places

Left Cody at 2:30 p.m., taking a slightly south-of-west course and passing over the southeastern corner of Yellowstone Park. It was necessary to reach a very high altitude to clear the high peaks of the Shoshone Mountains, which extend up to more than 14,000 ft., and with no landing fields to be found. In the event of a forced landing in this region, my selection would be one of the numerous glaciers which are to be found among the many crevices, some of which are several hundred feet in width and length, also surprisingly flat and level. The air conditions will be found extremely bad over these regions, and taking everything into consideration, are the worst I have ever flown over.

At a point about the eastern edge of the Park, my motor began missing badly, necessitating my losing altitude to make headway against the strong wind being encountered. Fortunately I was over the highest peaks, and looking down into Yellowstone Lake. Here several large meadows appeared to offer a safe landing place, but upon closer observation these were found to be obstructed with small ditches leading from springs higher up. After descending to an altitude of 8,000 ft. it was necessary that I land, as to run my motor at a high enough r.p.m. to climb sufficient to clear the mountains farther west meant to wreck it completely. By running at about 1250 r.p.m. it did not vibrate badly, so I began a search for a landing field, finally landing in "Upper Geyser Basin." Here steam is escaping in hundreds of places, but at the northern end of this basin will be found a large green meadow which is about 400 ft. by 900 ft., obstructed along the eastern side with timber, also telephone line along the road leading through here. Extending from this grassy area to the south, and up to several geysers, an open level area of perhaps forty acres will be found. This appears from the air to be firm and hard, but it is not. I landed on the grass, but slightly across it, running out upon the open area before coming to a stop, turning up on my nose. Fortunately I had cut the switch, the propeller stopping horizontal, no damage being done.

After four more days of flight, with stops at Idaho Falls, and Boise, the flier was headed for Spokane.

Snow and Wind in Mountains

Left Boise 3:30 p.m., expecting to make Spokane, Wash., the next stop, but had not gone more than fifty miles when snow encountered along the foothills of the Sawtooth Mountains. Here I changed my course to one slightly more west, thinking that perhaps the snow storm was limited to this mountain range. At a point where the Malheur river empties into the Snake, snow was again encountered and this extended well into the mountains in eastern Oregon. There was a strong northern wind of about 35 m.p.h. velocity. Finally forced to land at Jamieson, Oregon. The population here is about 25, with no accommodations available. The plane had been taxied up close behind a large haystack, for protection from the wind. The same haystack served as hotel for the night. Landing was made at Jamieson 4:45 p.m. Alt. 4000 ft.—snowing.

Took off from Jamieson 8:20 a.m. October 18th, heading into a wind of about 30 m.p.h. from the north. Extremely cold with snow clouds hanging low over the mountain ranges

to the north. After taking off and flying for perhaps thirty minutes, I realized that an attempt to go through to Spokane was foolhardy, so decided to return to starting point, Eugene, and complete itinerary by rail, as weather conditions throughout this section were becoming entirely unsuited for airplane travel.

The roughest country flown over was that within, or adjoining the Yellowstone National Park, where will be found solid timbered areas with not a single safe landing field for a hundred miles, at times.

The only motor trouble experienced was that caused by spark plugs fouling, this being due, I think, to using various grades and qualities of lubricating oils.

This type plane should not be used in navigating over territory such as was found on this trip. Safe landings could be made in but comparatively few places. Hundreds of small fields will be found in which a plane could be "stalled," a collision with a tree, of course, being inevitable, but the crew would have more than an even chance of escaping without serious injury if the gasoline tank was in front of the pilot, i.e., located over the center of gravity, with pilot and observer located in rear as in the D.H. 9. To move the gasoline tank forward and leave the landing gear as at present will cause this plane to nose over more easily than at present, which is entirely too marked for landing in the average field found throughout farming districts. The landing gear should not be moved forward, but rather change the angle of the chassis struts, throwing the wheels farther forward.

Problem Course in Electricity

BY H. H. BLISS

(What have resistance and friction to do with the efficiency of your generator? Do you know the meaning of eddy current loss and hysteresis loss? The following article, the sixteenth of a series, takes up the various causes of losses in generators and their relation to operating conditions.—The Editor.)

GENERATOR LOSSES

Power for Magnetization.—With the exception of magnetos, all generators require the expenditure of energy in magnet windings. This energy is entirely dissipated in heat radiated from the field coils, and the amount consumed is exactly the same as if there were no iron in the coils—the lines of force are not the recipients of energy (after they are once established) any more than is the flux of a permanent magnet.

The watts consumed in a field coil equal the product of the amperes flowing in it times the voltage across it, or (since volts = amperes $\times$ ohms) **watts = amperes $\times$ amperes $\times$ ohms.** Thus the power wasted in heating the field windings of a 500-kw. alternator which takes 90 amperes equals $90 \times 90 \times 1.3 = 10{,}530$ watts, if their resistance is 1.3 ohms. The exciter voltage in this case would be $90 \times 1.3 = 117$. The 10.53 kw. are known as the "field copper loss" or "excitation loss"; here it amounts to 10.53/500 or 2.1% of the output. With smaller machines it is relatively higher, amounting to 4% or more with small d.c. generators. The losses in both shunt and series fields are to be added to give the total figure for compound wound machines.

With d.c. generators there is a loss in the shunt field rheostat, averaging about 10 to 20% of the total power used in the shunt circuit. The small amount of power used in the series shunt is also charged to excitation.

Armature and Commutator Resistance Losses.—It requires power to force the current through the inductors in the armature and their connections to each other, and to the commutator. This, like all other wasted power, results in the development of heat, and as the temperature of the copper rises its resistance increases, thus causing a still greater loss of power. Equilibrium is reached when the heat is dissipated by radiation and ventilation as fast as it is produced, for then the temperature and resistance reach values which do not change.

For calculating the amount of the copper loss in the armature, one may figure on the loss in each inductor and end connection, taking watts in each = amperes squared $\times$ ohms, and adding the results. It is often simpler to take the whole armature resistance and multiply it by the square of the total armature current, and this gives the same answer.

As the load varies, the armature current alters to correspond, changing the amount of the copper loss. But since the loss depends upon the square of the current, it increases more rapidly than the load. For instance, a certain d.c. machine has an armature resistance of .03 ohm. When it delivers no current its armature copper loss is $0 \times 0 \times .03 = 0$; with 40 amperes it is $1600 \times .03 = 48$ watts; with full load, 120 amperes, it is $14400 \times .03 = 432$ watts, or nine times that at 1/3 load. At half load it would be ¼ the full load loss, while at 100% overload the loss is 1728 watts.

It is to be emphasized that the copper loss in alternator armatures is figured exactly as in d.c. armatures, as the quantity **"amperes^2 $\times$ ohms"** accurately represents the watts consumed in forcing either direct or alternating current through a resistance.

There is always an appreciable resistance at the contact between a carbon brush and a metal commutator or collector ring. This resistance varies with the condition of the surfaces, the temperature, the "current density" or amperes per square inch of contact area, and the pressure holding the brush against the metal. Under average conditions the voltage drop between metal and brush is in the neighbrohood of one volt, and this does not vary greatly in a given machine when the load is gradually changed, because the **resistance decreases as the current increases.** Hence the power loss at brush contacts may most easily be figured as amperes times volts drop.

Friction and Windage.—Mechanical friction consumes part of the input of a generator, as it does in the case of any other machine. We may take up separately three different kinds of friction which are found in nearly all generators: bearing friction, "windage" or air friction, and friction between brushes and collector rings or commutator. The loss

of power in each case depends upon the frictional or retarding force and the rate of movement, just as the watts used to overcome electrical resistance depend upon the electromotive force and the rate of current flow.

The number of watts consumed in friction in bearings well lubricated with machine oil may be computed from the alignment chart in Fig. A. For

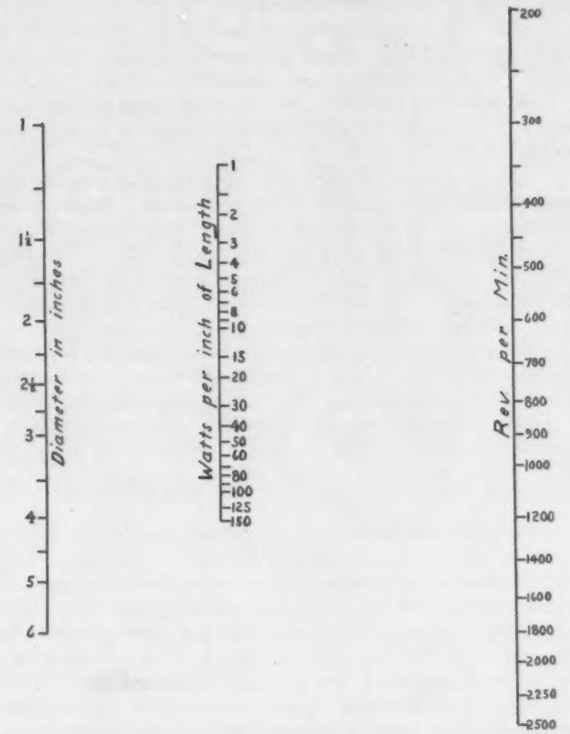


Fig. A.—To determine the watts of friction loss in a bearing, lay a straight edge across this chart, connecting the diameter of the shaft with the speed in r.p.m. Then multiply the length of the bearing by the number found where the straight edge crosses the center line of the chart.

example, with a bearing 2½ inches in diameter running at 700 r.p.m., the watts loss per inch of length of the bearing = 20, as indicated by laying a straight edge from the mark 2½ on the left line to the number 700 on the right. If the generator has two bearings, each 6 in. long, the total loss here is 12 × 20 = 240 watts. It will be noted that, due to the shortness of the center line, the chart can not be used for more than a limited range of speeds; the reason is that the friction in bearings varies according to different laws at very low and very high rubbing speeds. However, the chart will be applicable to many of the cases which occur in practice with machines of moderate size.

Brush friction varies with the area of the brushes and the brush pressure against the ring or commutator. The pressure is usually about 1½ lbs. per sq. in., and the following formula is based upon this figure. The loss in watts is found experimentally to equal .0025 times the contact area of all the brushes (in sq. in.) times the diameter of the commutator or ring (in inches) times the speed of rotation (in revolutions per minute), or **Watts = .0025 × area × diameter × r.p.m.**

What is the power used in overcoming commutator friction in a machine with four brush groups, each having an area ¾ in. by 8 in., the commutator being 13 in. in diameter and running at 1000 r.p.m., and each brush group being held to the commutator by a spring force of 12 lbs.? If the pressure were 1½ lbs. per sq. in., the watts would be .0025 × 4 × ¾ × 8 × 13 × 1000 = 780; but the pressure = 12/6 = 2 lbs. per sq. in., and hence the friction loss = 780 × 2/1.5 = **1040 watts.**

The windage loss is very difficult to calculate, and it is not often measured separately in tests, as it has been shown to be small for ordinary machines run at moderate speeds.

Iron Losses.—The repeated magnetization and demagnetization of the iron in generator armatures requires the expenditure of power, known as the "hysteresis loss," which produces heat in the body of the iron. Each cubic inch of the metal absorbs during one "cycle" of magnetization (a period during which the flux is twice reversed in direction) an amount of energy dependent upon the quality of the iron and the flux density. The following table gives approximate values for the watts per cubic inch for one cycle per second with various grades and different densities. The figures in the third and fourth lines apply to wrought iron as well as to sheet metal.

WATTS PER CU. IN. HYSTERESIS LOSS AT ONE CYCLE PER SECOND

	Lines per Sq. In.			
	50,000	80,000	100,000	120,000
Cast iron, medium	.035			
Hard cast steel	.076	.163	.230	
Low grade sheets	.015	.032	.045	.061
Medium sheet metal	.008	.017	.024	.033
Best sheet steel	.003	.007	.010	.013

What is the hysteresis loss in an armature driven at 1200 r.p.m. in a 4-pole machine if it contains 500 cu. in. of best sheet steel worked at 90,000 lines per sq. in. and 80 cu. in. of teeth worked at 110,000? By "interpolation" between the figures for 80,000 and 100,000 lines we find the tabular figure as .0085 for the body of the armature, and similarly .0115 for the teeth. Call them .009 and .012. The cycles per second = 2 × 1200/60 = 40. Then the loss = 40 × 500 × .009 + 40 × 80 × .012 = 180 + 38 = **218 watts.**

When a solid iron cylinder shaped like an armature core is revolved between poles as shown in Fig. B, a current, induced by the cutting flux, is found to flow in the path indicated by the dotted line. This "eddy current" (so called because it resembles an eddy in a stream of water) heats the metal and also sets up a torque opposing the motion of the armature in exactly the same way as does the regular armature current in the copper inductors.

An armature body made in four layers insulated from each other, as in Fig. C, would have much weaker eddy currents, since the voltage in each part, one-fourth as great as in the previous case, would meet much more than one-fourth the previous resistance in forcing the current back and forth through the armature. Hence armature cores are invariably

made of "laminated" (sheet) metal set perpendicular to the shaft. It is customary to use such a thickness that there are about 70 sheets to the inch.

In the table below is given the eddy current loss (in watts per cubic inch) in ordinary generator sheet metal 1/70 inch thick, at various flux densities (in lines per square inch). This loss depends upon the **square of the frequency,** being, for example, 100 times as great at 10 cycles as at one cycle per second.

WATTS PER CU. IN. EDDY LOSS IN ORDINARY ARMATURE IRON

Flux Density	1 cycle per sec.	10 cycles per sec.	25 cycles per sec.	60 cycles per sec.
50,000	.000023	.0023	.0144	.083
80,000	.000057	.0057	.0356	.205
90,000	.000071	.0071	.0444	.256
100,000	.000085	.0085	.0532	.306
110,000	.000102	.0102	.0638	.367
120,000	.000122	.0122	.0762	.439

Why should doubling the frequency quadruple the power consumed in eddy currents? First because the doubly rapid cutting by the lines of force results in inducing double e.m.f., and second because this higher e.m.f. causes twice as great a current as formerly. The product of volts × amperes, or watts, is then four times the previous amount. Thus follows the rule: "To find the eddy current loss for any frequency, **multiply the loss at one cycle per second by the square of the frequency.**"

After one has computed hysteresis and eddy losses by the methods outlined, the figures will invariably be found lower than test results for generators, as other factors enter to complicate the situation. These include the increase in eddy currents in the teeth due to the jamming and burring of the laminations there, the eddy currents set up in the pole faces as the armature teeth and slots vary the flux distribution in the air gap, the eddy and hysteresis losses in solid iron or steel spiders and frames reached by parts of the flux, and other accidental or unpredictable variations in magnetic action. It is safe, then, to assume a total iron loss two or three times as great in most actual machines as calculated from the tables given herewith.

Solutions of Previous Set

167. There being 17 slots and one coil spanning 4 of them, the distance = 4/17 of 3.14 × 12 = **8.86 in.** Each turn is 2 × (10 + 8.86) = 37.7 in. long; 24 × 37.7 = **906 in. per coil.** Of this length 20 × 24/906 = **53%** is active.

168. 3.14 × 50/10 = 15.7; 15.7 + 1 = **16.7 in.** 25/41.7 = **60%.**

169. One inductor has 5 volts induced in it by passing 400 × 10/60 = 66.67 poles per second. As it cuts 500,000,000 lines per second, each pole furnishes 500,000,000/66.67 = 7,500,000 lines to the armature. Total flux in a pole = 7,500,000 × 1.2 = 9,000,000, of which one-half or **4,500,000 lines** travel each way in the frame.

170. Combined resistance = .0008 ohm. Drop = **1.6 volts** and the shunt current = 1.6/.004 = **400 amperes.**

171. 13 × 20 × .39 = 101 sq. in.; density = 12,100,000/101 = 120,000, requiring 360 ampere-turns per inch. 1.25 × 360 = **450 ampere-turns necessary.**

172. Area of ends of teeth = 104 sq. in.; pole spans 13 slots as well as 13 teeth, an additional area of 13 × 20 × .45 = 117 sq. in., or a total of 221 sq. in. Mean area of air gap = (221 + 104) ÷ 2 = 162.5 sq. in. Density = 12,100,000/162.5 = 74,400; .12 × 74,400/3.2 = **2,790 ampere-turns.**

173. **Clockwise rotation,** since the current flows away from the observer at the N pole.

174. As there are 17 inductors in series, volts in each = 32/17 = 1.882. Lines cut per second = 188,200,000, hence poles passed per second = 188,200,000/1,400,000 = 134.5. Then speed = 60 × 134.5/4 = **2020 r.p.m.**

175. Volts per inductor = 1,400,000 × 4 × 1300/(60 × 100,000,000) = 1.214. Hence inductors in series = 248/1.214 = 204. Since with one turn in each coil there were 17 inductors in series, we now have 204/17 = **12 turns in each coil,** and with two coil sides in each slot there are **24 inductors per slot.**

176. As there are six poles, there must be 3 cycles per revolution, or 3 × 1200/60 = **60 per second.** (This is the standard frequency in lighting circuits.) There being 300 inductors in series, the volts per inductor = .3333, indicating cutting by 33,330,000 lines per second. Since 6 × 1200/60 = 120 poles pass an inductor in one second, the flux in each = 33,330,000/120 = **278,000 lines.**

177. Generator is 6/7.5 or **80% efficient.** Input to engine = 40 × 120′/(.30 × .80) = 20,000 watts. 160 kw-hrs. = 546,000 B.t.u., which may be obtained from **28.7 lbs. of oil.**

178. Poles per second = volts × 100,000,000/(flux × inductors in series) = 230 × 100,000,000′(4,000,000 × 64) = 90, indicating 90/6 = 15 rev. per sec., or **900 r.p.m.**

Problems on Losses

179. The shunt field of a ten-pole generator requires a total of 80,000 ampere-turns. The coils, of 500 turns each, are wound two inches deep on cores 10 in. by 12 in. (including insulation) with No. 6 copper wire, of which the resistance is 1 ohm per C. M. inch. Noting that the average turn is a rectangle 12 in. by 14 in., find the length of wire in each coil and the volts applied to the ten coils in series.

180. Find the watt loss in each coil of the previous problem and the watts per square inch of radiating surface (exclusive of the ends of the coils) if the coils are 10 inches long.

181. In the above problems the brush voltage is 220. Find loss in the rheostat and what per cent this is of the total shunt field loss (which includes the rheostat loss).

182. A compound generator has 42 ohms in the shunt coil, which is connected across the brushes in series with the field rheostat. The latter is set on 8 ohms, and the brush voltage is 250. How many turns are there in each of the four field coils if the total ampere-turns in the shunt field = 6,000? Find the loss in the rheostat and the total loss in the shunt circuit.

183. An alternator carries 1500 amperes per inductor at full load. Each of the 72 inductors is made of 24 strips of copper in parallel, each strip being 1/10 in. thick by 4/10 in. wide. The length of an inductor is 40 in., and of an end connection 60 in. What is the armature copper loss at full load, at half load, and at 25% overload if the copper has a resistance of 11 ohms per C. M. foot?

184. A silver dime lies horizontally upon the upper end of an electromagnet. When the current is suddenly stopped in the magnet an eddy current is started flowing clockwise in the coin. With the help of Lenz's law determine which pole of the magnet was upward.

185. Tests of a certain carbon brush with 2 sq. in. of contact area give the resistance as .015 ohm when the current is 60 amperes, .010 ohm at 90 amperes, and .005 at 200 amperes. What is the voltage drop between commutator and brush in each case?

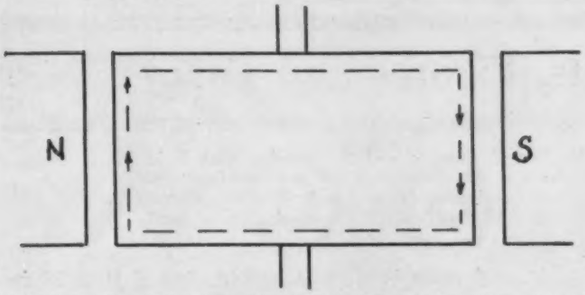


Fig. B.—In a solid iron armature core heavy eddy currents would flow because of the low resistance.

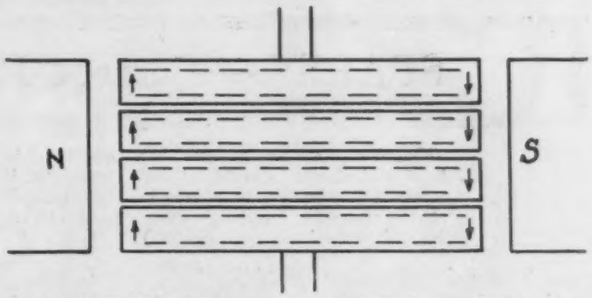


Fig. C.—Subdividing the armature core into layers perpendicular to the shaft increases the resistance to eddy currents.

186. The test mentioned above was conducted by changing the current gradually, so that each reading was taken after the temperature had come to a steady value corresponding to the current. With a sudden change of current the resistance was found remaining for a few minutes at practically the value it had before the change. What is the voltage drop in each case if the current changes suddenly from 60 to 90 amperes and immediately to 200 amperes?

187. What is the watt loss at one brush in each case in the two previous problems?

188. Find the friction loss in kw. and hp. in the three bearings of a 4-pole turbo-generator producing 60-cycle current if the shaft is 2¼ in. in diameter and each bearing is 8 in. long.

189. A shaft running at 440 r.p.m. in a bearing 12 in. long suffers a friction loss of .8 hp. Find the diameter of the shaft.

190. What is the speed of a generator which has a friction loss of 1.89 hp. where 10 groups of 6 brushes, each ¾ in. by 1¾ in., are pressed against the commutator of 36 in. diameter with a force of 1.97 lbs. per brush?

191. Explain why the eddy current loss in an armature is quadrupled when the thickness of the sheets is doubled.

192. Find the hysteresis loss in the stationary armature of an alternator with 16 poles run at 450 r.p.m. if the flux density in the teeth is 115,000 and in the main body of the armature 85,000. The inner diameter of the armature is 45 in.; the outer diameter is 50 in., the slots are 2 in. deep and the average thickness of a tooth equals twice the width of a slot. The length of the armature (measured parallel to the shaft) is 12.5 in., of which 20% is due to spaces between laminations and to ventilating ducts. Assume the quality as "medium sheet metal."

193. Find the eddy current loss in the above armature.

ELECTRICAL SERVICE LEAGUE FORMED IN SPOKANE

Forty men connected with various phases of the electrical industry, either as contractors, dealers, jobbers, manufacturers or central station men, have organized the Spokane Electrical Service League.

The objects of the league are to promote the growth of the electrical industry in all its branches, the coordination of effort in rendering better electrical service to the public, advancement along constructive lines within the industry in the way of encouraging sound ethical and progressive business methods by which a fair and reasonable return will be received on service rendered the public, and to encourage the greater use of electricity and electrical equipment.

Membership will be confined to individuals and not the concerns engaged in the industry. Officers elected were:

Chairman, M. W. Birkett, Washington Water Power Company; secretary-treasurer, D. W. Henderson, of the Austin-Henderson Company. Executive committee: The president and secretary-treasurer, and C. A. Marten, manager of the Western Electrical Company; C. V. Aspinwall, sales agent for the Westinghouse Electrical and Manufacturing Company, and H. D. Alton, Electrical Service Company.

NATIONAL ASSOCIATION URGES SUPPORT OF PUBLIC UTILITIES

The following set of resolutions was recently adopted at a meeting of the Executive Committee of the National Association of Electrical Contractors and Dealers in New York City:

"**Whereas,** The Executive Committee of the National Association of Electrical Contractors and Dealers recognize the present need of public utilities in general and electric light and power companies in particular in furthering their sale of securities to the public, be it hereby

"**Resolved,** That this committee shall offer its moral and active support in promoting the feeling of good will toward said interests, and urges the membership of the organization which it represents to do all in its power toward that end."

The National Association of Electrical Contractors and Dealers is to give this resolution the widest possible publicity through the association's official publication, the Electrical Contractor-Dealer, and through bulletins to the membership of the association.

ANOTHER ELECTRICAL BILL INTRODUCED IN CALIFORNIA LEGISLATURE

Another piece of legislation now pending, which has evidently been overlooked by the electrical industry, in the general maze of legislation now occupying public attention, is Assembly Bill No. 313. This bill, introduced by Mr. Burns of San Francisco, is "An Act for the regulation and supervision of persons engaged in the business of electrician, electrical worker, electrical contractor, electrical constructor, electrical engineer, electric light, heat or power utility, and creating a state board of electrical examiners; providing the powers and duties of said board, fixing the compensation of members of said board and of its employes, and to provide for the appointment of members thereof; providing for the enforcement of this Act and penalties for the violation thereof."

TEACHERS STUDY PUBLIC UTILITY PROBLEMS

An effective type of good-will publicity was inaugurated recently by the Pacific Gas & Electric Company, when a group of teachers from the grade schools of San Francisco was conducted through one of the company's generating plants. The teachers were very much impressed with the cooperative spirit shown, as well as the details of the plant and the extent of the company's operations. An enthusiastic report of the trip was published in their monthly magazine.

EDITOR CALLED BEFORE COMMITTEE

Journal of Electricity and Western Industry was recently complimented by having its editor, Robert Sibley, called to testify before the legislative committee now investigating the State Railroad Commission. Mr. Sibley told the committee of the importance of a sound development of the electrical resources of the state, and of the general esteem in which the Commission is held by the electrical industry for its appreciation of this fact.

SPARKS—Current Facts, Figures and Fancy

(Electricity as an insecticide is assisting both the Forest Service and the movies with light, heat and shock. Combined with dynamite, it has also proved effective in tidily removing brick walls. In addition to particulars on these interesting developments, a number of staggering statistics, with numbers running to eleven digits, are offered here to those who crave intellectual sensation.—The Editor.)

The sale of large electric lamps for 1920 is estimated at 230,000,000, against 183,000,000 in 1919, despite an increase in prices on April 1 of from 10 to 12 per cent.

* * *

The status of industrial development in the West is indicated by a recent census which shows that there are now 3500 factories of all kinds in the industrial districts around San Francisco Bay. About 1750 distinct commodities are made in this district.

* * *

The first commercial electric lamps, made in 1881, consumed nearly 100 watts and gave about 16 candle-power, having an efficiency of about 5.8 watts per candle. The present day lamp gives about seven times the amount of light for the same energy consumption.

* * *

Tungsten is 20 times as heavy as water—in other words, its specific gravity is 20; it melts at 3100 degrees centigrade; it is insoluble in many common acids, including hydrochloric and sulphuric; it is four times as strong as the best steel; and a piece of tungsten the size of a lead pencil contains enough material for about five miles of filament for 40-watt lamps.

* * *

Two hundred thousand dollars was the amount of the damage done by the western pine bark beetle in the forest country at the junction of California and Oregon during the past season. After trying various expensive and inadequate methods of extermination, the investigators have turned to electricity with marked success. Experiments are showing that electrocution works equally well on larvæ and adults of the species.

* * *

The total value of the mineral production of California for the year 1920 is estimated by the State Mining Bureau at $242,142,000, tabulated as follows: gold, $13,950,000; silver, $1,560,000; copper, $2,340,000; lead, $404,000; zinc, $121,000; quicksilver, $772,000; platinum, $40,000; petroleum, $104,000,000; chromite, $37,000; manganese, 78,000; magnesite, $840,000; natural gas, $4,000,000; brick, cement, crushed rock, etc., $16,000,000; miscellaneous "industrial" minerals, $2,000,000; salines (including borax, potash, salt, soda), $5,500,000.

* * *

Dynamite was recently used successfully by an industrial corporation for cutting down a brick wall 150 ft. long. The wall was 22 ft. high and 18 in. thick, and rested on a concrete foundation 18 in. below the ground level. It was desired only to take down the wall to the ground level. Twenty-six holes were cut into the wall just above the ground and dynamite tamped with clay in each hole. The charges were connected up in series and fired with electric blasting caps, cutting down the wall clean at the ground level. The total cost, including labor, was about $26.

* * *

Apparently following the example of the agricultural gentleman who used a vacuum cleaner to collect potato bugs, the movie people have invented a machine to remove the moths and other insects that fly around the lights and spoil many feet of film. The invention consists of a wide box, a carbon arc, 2000-candlepower lamps, a funnel, a suction fan and a large net. The moths are attracted by the light, cremated by the carbon arc, and drawn by the suction fan into the net. In a recent test the machine netted nearly ten pounds of bugs in less than that many minutes.

* * *

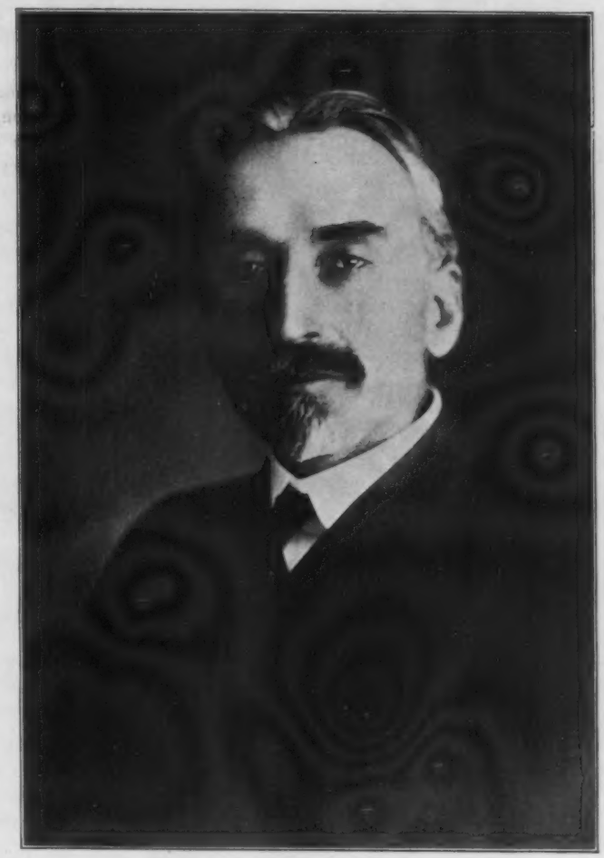
New Zealand's hydroelectric program, which includes the expenditure of about $100,000,000 for generating plants and transmission lines, is beginning to get under way. The government already has a big station in operation at Lake Coleridge, which has proved a financial success, and preliminary work has been done on another great station to be built at Manganhoe, near Wellington. This is intended as the first section of a complete system of transmission lines in the North Island. Only 500,000 hp., however, is estimated to be available in this island as compared with nearly twenty times as much in the South Island.

* * *

The light and power business of the nation is growing by leaps and bounds. The figures for 1919 are almost beyond comprehension. The 7,243 central station companies generated a total of 39,559,000,000 kilowatt-hours of energy and employed more than 100,000 men. This current was carried over more than 87,000 miles of high tension transmission lines, serving, in addition to the many industrial plants, more than 8,000,000 homes with light, and supplying light and power to more than 1,000,000 business establishments. Over 5,000,000 electric motors were in use at the end of the year. It is estimated that there are still about 14,000,000 homes in the United States to be wired for electric light, and something like 150,000 industrial concerns to be equipped with light and power facilities.

Builders of the West—XCVI

DR. J. D. PAXTON, that master of epigram, once said, "If a man preach a better sermon, write a better book, or build a better mouse trap than his neighbor, though he hide himself in the wilderness, the world will make a beaten path to his door." No better illustration of this aphorism can be found than in the story of Earl H. Richardson, the daddy of the Hotpoint Iron—a device which has carried the name of Ontario, California, to the remotest corners of the globe. Mr. Richardson did not invent the electric iron, but he developed it into a product which would give satisfactory service and which was sufficiently substantial to warrant the manufacturer's guarantee.



EARL H. RICHARDSON

Inventor of the Hotpoint Electric Iron, whose constructive imagination has carried a product of the West into every corner of the globe

This gentleman was born in Kilborn City, Wisconsin, in 1872 and spent his boyhood days in the saw mill towns of the Badger State. At the age of seventeen he went to Aurora, Illinois, where he was employed by the Aurora Street Railway Company which at that time was just changing over from horse cars to electricity. He is, in every sense, a self-made man. It was in Aurora that Mr. Richardson acquired most of his technical education through a correspondence course, and it was also here that he met Mrs. Richardson, whose common-sense ideas have been embodied in more than one electrical appliance.

In the nineties Mr. Richardson moved to California and was employed by the Ontario Power Company, where he advanced to the position of superintendent. This company received its power from the mountains near by and found itself in the position of having an abundant supply of power throughout the day while its market was limited to a few hours in the evening. Mr. Richardson was assigned the job of finding some outlet for this surplus power during off-peak hours and in this way his attention was first directed towards the electric iron.

His best prospect for a sale was in a local laundry where ironing was done ten hours daily, but the laundryman would not listen to Mr. Richardson's proposal, stating that the irons were hot enough in the middle, but the points were cold. The salesman-superintendent then decided to make a new iron which would get hot all over, and in November, 1905, he produced an iron and made a "scorch test" which was black at the point and shaded off to a light brown at the heel. This test was made on a Saturday afternoon and Mr. Richardson immediately sent word to Willis and Percy Booth, his associates in the venture. Sunday morning they made the journey from Los Angeles to Ontario to inspect the new device. After lunch they sat on the curb in front of the little shop and discussed the christening of the appliance. Richardson said, "We might call it the 'Pacific Iron,'" as the little corporation was then known as the Pacific Electric Heating Company. Willis Booth said, "No, that is not distinctive. Suppose we call it 'The iron with the hot point,'" and thus the Hotpoint Iron was launched.

At the same time the possibilities of electric cooking were being studied and Richardson built sixty ovens and sold them to his fellow citizens in Ontario. The first electric range, which he produced in 1904, is still in service. Other appliances were added from time to time and were given the Hotpoint name which had become a household word through generous advertising.

The immediate cause for electric iron was a commercial impulse to sell electricity during daylight hours, but Richardson had a fuller vision of its possibilities. He saw in it something that would relieve a portion of the hard work that comes before every housewife on Tuesday morning, something that would save the many steps between coal stove and ironing board, something that would put the heat where it was needed and leave the room and the worker cool. The justification of this dream is seen in the statement that last year over eight hundred thousand Hotpoint irons were sold. Some of the important markets where these devices are handled are Nome, Capetown, Hankow, and Bangkok. The king of Siam has a completely electrified palace and many of the Rajahs of India have their homes similarly equipped with the products of the factory which had its origin in Richardson's little shop.

From the beginning, Mr. Richardson has had charge of the manufacture of the Hotpoint line, his present position being manager of the Ontario works of the Edison Electric Appliance Company.

So here we have the story of a man who built a better mouse trap than his neighbor and the world has beaten a path to his door. To Earl H. Richardson, in appreciation of this magnificent accomplishment in behalf of the upbuilding of the West, this issue of Journal of Electricity and Western Industry is affectionately dedicated.

PERSONALS

Frank R. Devlin was recently elected president of the State Railroad Commission of California, succeeding E. O. Edgerton, whose term expired January 1. Mr. Devlin has served on the Commission since his appointment in January, 1915, succeeding John M. Eshleman on the latter's election as Lieutenant Governor. Mr. Devlin is by profession a lawyer, and previous to his appointment as a Commissioner served as District Attorney and Superior Judge of Solano county, California. Mr. Devlin takes great pride in the fact that he studied law during his enlistment in the United States Navy, and there qualified for his admission to the bar. During Mr. Devlin's six years of service on the Commission he has presided over some of the most important cases in the history of rate regulation in California. He has tended to specialize in power and hydroelectric matters and has handed down opinions and orders upon which the future power development of California will advance.

W. H. Young, electrical supply manufacturer of Chicago, visited San Francisco recently on business.

H. H. Schoolfield, electrical engineer of the Pacific Power and Light Company, of Portland, recently paid a visit to San Francisco and vicinity on business.

Victor W. Hartley, formerly associate editor and advertising manager with the Sperry Flour Company, has been appointed assistant secretary of the California Electrical Co-operative Campaign.

D. L. Huntington, president of the Washington Water Power Company, has been in Washington, D. C., and New York, on business connected with the hearing now going on before the Secretary of the Interior regarding a revocation of rights due to the overflowing of land in the Coeur d'Alene district.

A. G. Wishon, vice-president and managing director of the San Joaquin Light & Power Corporation, has returned from a three weeks' trip through the East in connection with the company's huge financial program. Mr. Wishon spent several days in New York and was agreeably impressed with the satisfaction expressed among bankers and bond houses over the outlook for the development of hydroelectric resources.

W. D. Benson, traffic manager, Frank Waterhouse & Company, for many years, and recognized on both coasts as one of America's leading railroad and steamship traffic experts, was recently promoted to vice-president of the Waterhouse Corporation, with jurisdiction over all its business east of Chicago. He will make his headquarters in New York City, where he has spent virtually all of the last two years. Mr. Benson joined the Waterhouse Company twenty years ago as general freight agent, coming to Seattle from St. Paul, where he was one of the freight experts of the Northern Pacific Railroad. During the war Mr. Benson played a great part in the gigantic Vladivostock cargo movement built up by Frank Waterhouse, founder and president of the Seattle Shipping Corporation. Mr. Benson is a member of the U. S. Shipping Board's standing committee of ship operators.

H. E. Byram, president of the Chicago, Milwaukee and St. Paul Railroad, was in San Francisco during the latter part of February.

Herbert J. Mayo has made arrangements to open a branch office in Los Angeles where he will represent the Benjamin Electric and Manufacturing Company.

A. W. Copley, general engineer of the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., is a recent Pacific Coast visitor and is spending some time in San Francisco.

Frederick W. Pratt, chairman of the board of directors, Stone & Webster Corporation, arrived in Seattle recently on a trip of inspection over the Corporation's properties in the Puget Sound district. He expects to be in this territory about a month, when he will return to the Boston offices.

H. L. Doolittle, electrical engineer, Southern California Edison Company, is a recent San Francisco visitor, as also is **E. E. Valk** of the General Electric Company in Los Angeles, **R. A. Hopkins** of the Westinghouse Electric & Manufacturing Company of Los Angeles, and **Lloyd Henley,** of the San Joaquin Light & Power Corporation of Fresno.

Elwood Mead, professor of Rural Institutions, of the University of California, has received an invitation from the Chamber of Commerce of New Orleans to attend a conference of the leading men of Louisiana to discuss the subject of a state-wide drainage and land settlement. Professor Mead is chairman of the State Land Settlement Board of California and has a national reputation.

G. E. Armstrong, Pacific Coast Editor of Electrical World, left the latter part of February for a two months' trip through the Pacific Southwest and Intermountain districts where he will visit all of the power companies and larger mining, industrial and irrigation centers using electrical energy, with a view to establishing closer contact with this field and Electrical World.

H. W. Young, president of the Delta-Star Electric Company of Chicago, who was in San Francisco in February investigating general business conditions, attended the meetings of the Technical Committee of the Pacific Coast Division of the N. E. L. A. Mr. Young expressed himself as being keenly appreciative of the strides being made on the Pacific Coast along industrial and engineering lines, and contemplates the establishment of a branch factory in the West in the near future.

S. C. Jaggar, Morrison Electric Company of Portland, has been appointed a member of the Advisory Committee of the Northwest Electrical Service League which is starting to do some real cooperative work in the Northwest. Mr. Jaggar has been very prominent in contractor-dealer work in Oregon, and has always been an active participant in all movements to promote the good of the industry as a whole. **A. J. Gladson,** Valley Electric Company of Yakima, **Harry Byrne,** North Coast Electric Company of Seattle, and **R. T. Van Ripper,** Edison Electric Appliance Company of Seattle, have also been added to the Advisory Committee of the Northwest Electrical Service League which is contemplating the installation of industrial lighting exhibits in Portland, Seattle and Spokane, and as soon as advisable to start "electrical homes" in these cities.

H. D. Randall, who was recently appointed district manager of the Denver, Colorado, office of the General Electric Company, has been connected with the electrical business for the last eighteen years. He graduated from Amherst in 1902, and the same year he entered the service of the Westinghouse Lamp Company, remaining with it until Jan. 1, 1904, when he went to Pittsburgh, where he was with the Westinghouse Electric & Manufacturing Company. After a year there he went to Seattle, Wash., and took charge of the Spokane office of the Westinghouse Company, remaining there for a year and a half. In 1908 he entered the employ of the Allis-Chalmers Company as salesman of hydroelectric apparatus, with headquarters in Salt Lake City. He was with the General Electric Company at Salt Lake City from July 1, 1912, until Dec. 1, 1914, going to Schenectady on the latter date, where he was connected with the power and mining department of that company. On Aug. 1, 1915, he became local manager of the Salt Lake City office, which position he held until Nov. 1 of last year, when he was made district manager of the Denver office. Since March 1, 1919, he has been president of the Capital Electric Company and the Butte Electric Supply Company of Salt Lake City. Mr. Randall has a wide acquaintance in the West and his eminently likeable qualities have made him many friends.

George C. Eggers, president of the Eggers Pole & Supply Company of Spokane, Wash., who handles the concreting of pole butts in power line installation, was recently in San Francisco on a business trip.

Harvey Ball was elected president of the Idaho Electrical Contractor-Dealer Association, at a meeting held in Pocatello recently. Mr. Ball is in business in Burley, Idaho, and was instrumental in the formation of the association.

L. M. Klauber, chief engineer of the San Diego Consolidated Gas and Electric Company and chairman of the Engineering Committee, Pacific Coast Division of the N. E. L. A., attended the meetings of that committee held recently in San Francisco.

Leroy C. Williams, insulator specialist of the Westinghouse Electrical and Manufacturing Company of San Francisco, has left the employ of that company and will be engaged in private business. Mr. Williams was formerly with the Pacific Gas & Electric Company, in the transmission department.

M. O. Lokensgard, who has been superintendent of the Rocky Mountain division of the circulation department of the McGraw-Hill publications, has been transferred to the San Francisco office of the company. The Rocky Mountain and Pacific Coast divisions have been consolidated and Mr. Lokensgard is in charge of the circulation in this enlarged district. **Homer Beach** has been transferred from the Denver to the Los Angeles office.

Clyde L. Chamblin, president of the California State Association of Electrical Contractors and Dealers, was elected president of the San Francisco Electrical Development League for the ensuing year. Mr. Chamblin, by his able and constructive work in the Contractor-Dealer Association, and as a member of the Advisory Committee of the California Electrical Cooperative Campaign, has demonstrated his ability to carry on the good work of the Development League.

P. V. Moffat, who has been assistant credit agent for the Southern California Edison Company since April, 1919, has been advanced to the position of credit agent.

H. A. Barre, executive engineer of the Southern California Edison Company, and **R. J. C. Wood,** electrical engineer, were recent San Francisco visitors.

A. E. Douglass, professor of engineering of the University of Arizona, at Tucson, attended the Seasonal Weather Forecasting Convention in San Francisco.

L. C. Bullington, assistant manager of the Westinghouse Electrical and Manufacturing Company, of East Pittsburgh, made a trip recently to California on the Wolverine State.

G. B. Clark, president of the Duralectric Corporation, Jamestown, New York, is in Los Angeles making arrangements to open an office for his company in that city.

H. S. Ross, formerly in charge of the record department of the Southern California Edison Company, has been transferred to the right-of-way department, and **F. W. Morris** has been advanced to the position of record clerk.

E. E. Baker, for many years secretary of the Mount Whitney Power and Electric Company, has been appointed traveling auditor for that company, and will check the consumers' accounts in the San Joaquin districts.

Robert Johnston, who has been the representative of the Federal Electric Company in Salt Lake City for the past four years, has been transferred to Oakland, California, as sales manager of that district.

Robert McDonald, formerly manager of the Oakland branch of the Fobes Supply Company, is now sales manager of the San Francisco office of that company. **W. E. Ayden** succeeded Mr. McDonald as manager of the Oakland branch.

O. W. Peterson, who has been recently with the Sutter Construction Company, engaged in the construction of the diversion tunnel of the Caribou project of the Great Western Power Company, is now employed with the Pacific Gas & Electric Company as engineer of construction on the Pit river development.

B. F. Pearson, general superintendent, Southern division, of Southern California Edison Company, has just finished his twenty-fifth year's service with that organization and on the night of January 29th he was the guest of honor at a reception and dance held in the Brunton Studios at Hollywood. Short addresses were made by President **John B. Miller,** Vice-President and General Manager **R. H. Ballard,** and Vice-President **George C. Ward,** followed by Vice-President **S. M. Kennedy** who represented the employes in presenting Mr. Pearson with a gold watch. Over 2000 employes attended to pay their respects to "Uncle Ben," as he is popularly known throughout the Edison system. Mr. Pearson was born in Middlesex county, England, Sept. 19, 1868. He served an apprenticeship with the Grand Junction Canal Company, England, as an engineer and fitter. Immediately afterward he came to the United States and in January, 1896, entered the employ of the Southern California Edison Company. In addition to his duties as general superintendent and power administrator, Mr. Pearson is chairman of the engineering committee of his company, which has the engineering responsibility of the organization. Mr. Pearson is identified with many public and philanthropic movements of Southern California.

Window display at the Better Merchandising Show, showing proper manner of effectively displaying fans and other current-consuming devices. Note the valance at the top of the window which keeps the light out of the customer's eyes.

Effective counter display which makes use of small package goods as displayed in and out of cartons. Special notice should be given to the partitions separating the various kinds of articles and to the booklets explaining their uses.

Westinghouse Better Merchandising Show

The growth in the use of electric appliances in the home and in the industries has been so phenomenal as to create an urgent need for improved merchandising methods. In order to assist in strengthening the contractor-dealer branch of the industry to meet this demand and give service to the buying public throughout the country, the Westinghouse Merchandising Bureau, which is made up of the Westinghouse Electric & Manufacturing Company, the Westinghouse Lamp Company, and affiliated companies, has developed a traveling exhibit known as the "Westinghouse Better Merchandising Show," the purpose of the show being to create a wider knowledge and to obtain a more general practice of modern merchandising methods among jobbers and contractor-dealers.

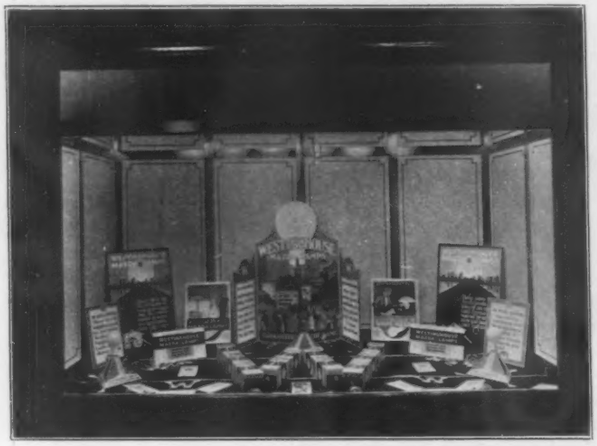
The San Francisco office of the Westinghouse Company has announced that the Better Merchandising Show will be exhibited in San Francisco to jobbers and contractor-dealers from February 28 to March 5, inclusive. The first three days, February 28, March 1 and 2, will be devoted to the Westinghouse organizations, the Electric, Railway & Manufacturers Supply Company, Westinghouse agent-jobbers in San Francisco territory, and the Westinghouse Lamp Company jobber-agents. Special programs have been prepared.

On March 3, 4 and 5 the show will be exhibited to dealer-contractors in the San Francisco and peninsular cities, all of whom have been invited by special invitations.

After the completion of the show in San Francisco, it will be moved to the Hotel Oakland, Oakland, California, and exhibited to Oakland and bay cities contractor-dealers on March 8, 9 and 10.

The show in part consists of a series of twenty wall panels illustrating in concrete form by means of photographs, diagrams and extracts from advertising material, the various forms of correct merchandising practice. There is also a pair of simulated show windows, which demonstrate the possibilities of window illumination and good window trimming.

It is the purpose of the Westinghouse Company to exhibit the Better Merchandising Show in at least fourteen cities in the San Francisco territory. The name of the town and date of exhibitions will be announced at a later date. Every contractor-dealer is cordially invited to attend.



Lamp cartons and special posters can be used effectively in dressing a window. This is a single idea window and is well balanced, the letter W formed from the cartons, bringing home forcibly the trade mark of the manufacturer.

One corner of the exhibit showing some of the charts used to illustrate the various forms of correct merchandising practice, including proper forms of advertising which should be used by the contractor-dealer in the local newspapers.

HAPPENINGS IN THE INDUSTRY

A ROAD ON THE OLYMPIC PENINSULA
Roads and trails were made impassable and scores of settlers were isolated. Eight million feet of fir, spruce, hemlock and cedar were virtually destroyed.

FOREST MONARCH UPROOTED BY STORM
The roots of this tree measure thirty feet across. It is one of thousands torn out of the ground by the tornado which swept the Puget Sound district recently.

WORST STORM IN YEARS STRIKES WASHINGTON COAST

A tornado which swept over the Olympic Peninsula, bordering the Pacific ocean, in the extreme northwestern part of the state of Washington, on January 29th, destroyed timber estimated to be worth at least $150,000,000. According to T. F. Kennedy, special agent for the Milwaukee Land Company, and Charles Morganroth, assistant U. S. Forest Supervisor, 8,000,000,000 feet of fir, spruce, hemlock and cedar was uprooted and virtually destroyed.

The figure of $150,000,000 is based upon the average value of logs at $18 per thousand feet. The loss in terms of county roads is in excess of $75,000; trails, $50,000; telephone lines, $25,000; houses and buildings, $100,000.

A strip of timber stretching for a distance of 70 miles along the coast is virtually all down. It is estimated that 62% of the fallen timber is hemlock, 20% spruce, 10% cedar, and the remainder Douglas fir.

The storm caused the greatest timber disaster in the history of the Northwest, and Government forest officials are extremely fearful of tremendous forest fires in the ravaged area. Governor Hart and state officials are taking steps to protect the district from the fire menace, and to determine what emergency measures may be taken toward salvaging a portion of the timber. The loss of telephone lines is considered one of the great contributing factors to fire loss.

Thousands of small timber owners are affected by the terrific havoc of the storm, as are the state of Washington, State College and University of Washington holdings.

Although to date no loss of life has been reported, there are from twenty to thirty families in the Clearwater, Bogachiel, Hoh, and Queets River districts that have not been heard from. All trails to those settlements have been completely covered, and it will require weeks to reach them with supplies.

Henry Morganroth is authority for the statement that the extent of the damage wrought can hardly be exaggerated, stating:

"It will be a long time before the full extent of the havoc can be determined. The storm has swept the territory as far north as Pysht, Clallam and Hoko rivers, along a strip of territory at least 30 miles wide. It extended in a southwesterly direction toward the Queets and Quinault rivers, a distance of approximately 70 miles, or about 2200 square miles. In this area, there are some patches that escaped, but not many. In the Hoko district, where the Government secured its best airplane spruce during the war, the storm swept the territory nearly clean, leaving in most instances the scrubs. In the Hoko territory there was a stand of 450,000,000 feet of spruce, more than 50 per cent of which is now down.

"All along the coast the hemlock has suffered, and vast areas have been swept clean. The brush that lies on the ground in this district represents millions of gallons of turpentine, which may destroy the great Olympic forest at any time. Something must be done before the summer months, when the danger of fire is augmented a hundred fold."

LATEST PLANS OF NEXT ANNUAL N. E. L. A. CONVENTION

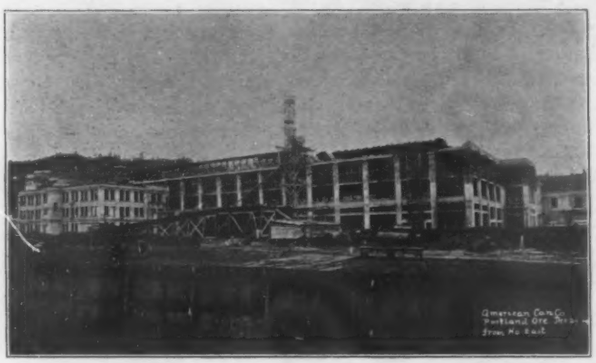
Announcement was made in the last issue of Journal of Electricity and Western Industry that the forty-fourth convention of the N. E. L. A. will be held at the new Drake Hotel, overlooking Lake Michigan in Chicago, May 31 to June 3, inclusive. This announcement was made following a conference at national headquarters, Monday, January 24, between President Insull, Vice-Presidents M. R. Bump and Frank R. Smith, and Chairman I. E. Moultrop, of the Technical National Section, and Chairman M. S. Seelman, of the Commercial National Section. This conference was authorized by the Executive Committee at its last meeting upon the request of President Insull, who stated that he desired the advice and assistance of the vice-presidents of the Association and the chairmen of the four national sections.

The convention will open Tuesday morning, May 31, with a general session to be convened at 10 o'clock. It will close Friday night, June 3. Chicago was decided upon as the convention city after careful consideration had been given to invitations received from other points. Some time ago the choice had simmered down to Hot Springs, Ark., and Chicago, many arguments being advanced in favor of each place. So strong was the sentiment in favor of Hot Springs that President Insull and Executive Manager Aylesworth journeyed to that point early in the month and looked over the situation.

They found almost ideal surroundings, and were assured by the people of Arkansas that a true southwestern welcome would await the visitors, should the convention be held in Hot Springs.

Because of the conditions attendant upon the reconstruction period, careful consideration led President Insull and his advisers to the belief that this year it would be absolutely essential to hold the convention in a central place, easily accessible from all parts of the country, and that geographically, and from a point of view of transportation, Chicago was the logical point at which the convention should be held. One of the principal factors considered in arriving at this decision was the necessity for the leading men in all branches of the industry to pay close attention to the details of their own business, and to keep their fingers upon the pulse of local happenings in the communities which their companies served. This, they felt, was true from the standpoint of finances and merchandising because of present business conditions, and from the viewpoint of technical experts, because of the tremendous development being undertaken in the electrical industry during the year 1921.

The new Drake Hotel is located at Lake Shore Drive and North Michigan Avenue, formerly called Lincoln Parkway. It is reputed to be the most modern hotel in the United States in every particular, and the N. E. L. A. convention will be the first to be held in the hotel following its completion.



NEW $1,000,000 FACTORY OF THE AMERICAN CAN COMPANY AT PORTLAND

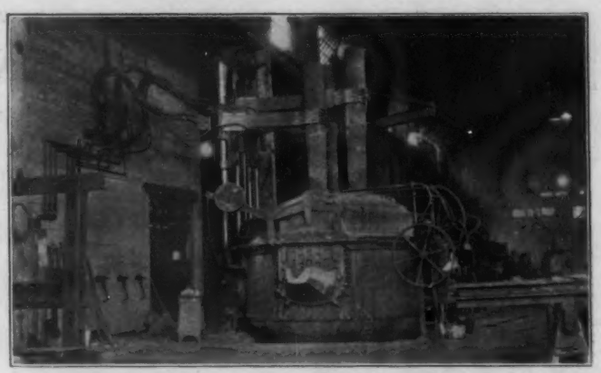
This plant will be completed and in operation by summer of this year. It is the largest and most modern can factory west of Chicago and will be electrically operated throughout and will employ 1000 men to start with. The increased demand for fruit cans and the general growth of the company's business has made necessary the construction of this immense factory. There will be an installed capacity in motors of over 500 hp. Electrical service will be supplied by the Portland Railway Light & Power Company.

SOUTHERN PACIFIC PLANS INTERURBAN TERMINAL IN OAKLAND

The Southern Pacific Company has asked the California State Railroad Commission for a rehearing of the Commission's order directing the erection of a $50,000 depot at 14th and Franklin streets, Oakland. The company gives as a reason for this request the fact that it is considering the plan of Oakland capitalists to erect a six-story office building under a fifty-year lease from the company.

The plans for the office building proposed provide for an arcade or open space upon the ground floor for the passage of such suburban and local trains as the company might operate and space for adequate waiting rooms, ticket offices and other conveniences for passengers.

Coincident with the notice of the proposed construction, the company informs the Railroad Commission that it proposes to abandon a material part of the electric service operating over the terminal property.



ELECTRIC FURNACE INSTALLED IN NORTHWEST

Three-ton, 1500-kw., Moore Rapid Electro Melt steel furnace, installed at the plant of the Electric Steel Foundry Company, at Portland. This company has had in use two electric steel furnaces for several years, for the production of steel from high grade scrap, and has added this new furnace to supply the growing demand for mild steel castings.

ANNUAL REPORT OF PACIFIC LIGHTING CORPORATION SHOWS SUBSTANTIAL GROWTH

The annual president's report to the stockholders of the Pacific Lighting Corporation, for the year 1920, shows a total dividend on preferred and common stock of $832,100. Extracts from the report follow:

The growth of Los Angeles and the country adjacent to it necessitated large capital expenditures. Over 70 miles of gas mains were laid, about 99 miles of main line wire run, and additions made to the plants necessary to properly supply the 17,889 meters gained during the year.

The net cost of its betterments made during the year was $1,419,361 in the gas department, $436,033 in the electric department, and $68,899 for general purposes, the total aggregating $1,924,294.36.

On February 1, 1921, there were registered 388 holders of the Corporation's common stock, and 449 holders of preferred stock, against 366 and 427, respectively, one year earlier.

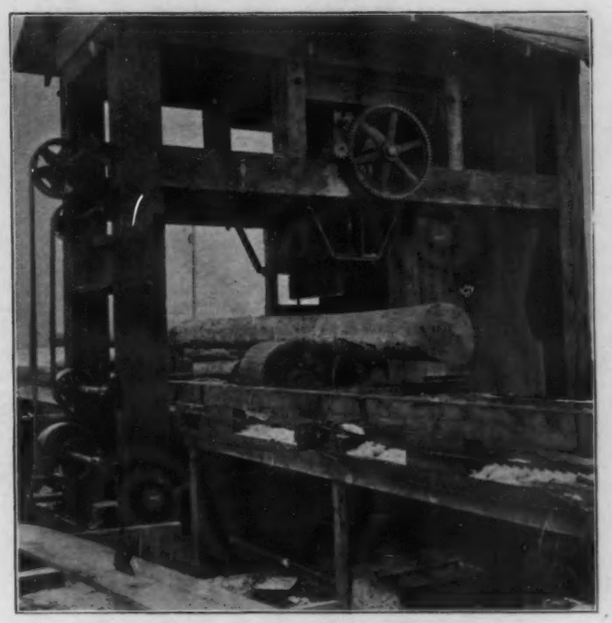
OKANOGAN POWER COMPANY BUILDS NEW DAM

The Okanogan Valley Power Company has commenced operations in its new plant and the old works have been abandoned. The installation is in Okanogan county about 100 miles north of Spokane and is a considerable factor in the development of the surrounding district in the Okanogan, Methow and Columbia rivers valleys.

The new dam and power house was designed to furnish 5,500 horsepower. The initial unit of 2500 hp. is in operation and the mechanical plant is giving complete satisfaction. This will probably suffice for the requirements for the district for the next two or three years. Power is transmitted to a number of towns in the district for domestic purposes and is also employed for pumping on irrigation undertakings and at mining plants. A 55-foot concrete dam was constructed in the Similkameen river four miles north of Oroville. The plant is modern in every particular.

SITE OF DAM AND POWER HOUSE OF OKANOGAN POWER CO.

This plant is designed to furnish 5,500-hp. for local use in the country immediately adjacent



SHOWING METHOD OF HANDLING POLES
The pole is transported under the bars by live rolls and is raised into position by the hoist shown above.

PUNCTURING MACHINE FOR IMPREGNATION WITH CREOSOTE
The use of this machine is said to insure a full sap penetration with either green or seasoned cedar poles.

IDAHO COMPANY INSTALLS IMPROVED TYPE OF WOOD PRESERVING MACHINE

An improved puncturing machine designed to puncture the sapwood of red cedar poles at the butt to permit a thorough impregnation by creosote has recently been put in operation by the Western Cedar Preservers Company at Sandpoint, Idaho. This machine is said to represent a long step forward in the preservation of cedar poles. It assures a full sap penetration with either green or seasoned poles treated by what is known as the "B" method.

This consists of immersing the poles from 4 to 12 hours in an oil bath heated to from 212 to 230 degrees Fahrenheit, followed by a cold oil treatment of from 2 to 6 hours.

The puncturing is done by 42 iron bars four and one-half feet long, three inches wide and three-quarters of an inch thick, which weigh approximately 37 pounds each. A detachable point holder on each bar makes possible the regulation of the depth and spacing of the puncture. At present, chisel-shaped points one-half inch long, spaced so that if the oil travels one and one-half inches lengthwise of the pole and one-eighth inch crosswise, a complete penetration will be obtained, are in use.

Each bar works independently of all the other bars in order to take care of the irregularities of the pole. These bars are raised by cams and drop by gravity. The machine is constructed so that the operator can regulate the distance the bars drop by simply raising or lowering the hoist on which the pole rests. The pole is transported under the bars by live rolls and then raised into position by hoists. The part of the pole to be punctured is supported on two oscillating wheels, 24 inches in diameter and 18 inches wide. These wheels are so constructed that no matter what position the pole is in or what taper it may have, it will have a full 18-inch bearing surface on the two wheels.

Discussing the results obtained, W. M. Leavitt of Spokane, manager and secretary of the company, said in a paper read before the American Wood Preservers at their seventeenth annual convention in San Francisco this past January:

"The time at which complete impregnation may be observed varies from the time the pole is removed from the treating tank up to two months after the time of treatment. In a properly punctured pole, we have not, however, had a single instance where we did not eventually secure a complete impregnation to the depth of the puncture providing the puncture did not enter the heart wood."

BRITISH COLUMBIA ELECTRIC RAILWAY COMPANY TO CHANGE NAME

The British Columbia Electric Railway Company, Vancouver, B. C., has applied for a federal charter under the name of Vancouver, Fraser Valley and Southern Railway Company, which is the name of one of its interurban lines at present in existence. The intention is that the Vancouver, Fraser Valley and Southern Railway should, under its new charter, take over the whole of the company's properties, consisting of city and interurban lines in Vancouver, North Vancouver, New Westminster and Victoria, and its light and power systems with the exception of its power plants. The new charter does not include the company's gas properties. It is proposed also to change the name of the Vancouver, Fraser Valley and Southern Railway back to the British Columbia Electric Railway Company, or a similar name.

The object of this move is to place the company under the jurisdiction of the Board of Railway Commissioners of Canada, a federal body, and by that means obtain the stability as regards fares and rates which will enable the company to raise new capital. At the present time the company is temporarily under that commission, having been taken under federal control in 1919 by an Act of Parliament which was not intended to operate on electric railways. The Parliament of Canada at its last session passed an amending Act returning the B. C. Electric Railway Company to provincial jurisdiction about July 1, 1921. Owing to the abolition of the Provincial Public Utilities Commission, this would thrust the company back on its original franchises which call for a five-cent fare, although a six-cent fare and a seven-cent suburban fare are the rates now charged. The alternatives before the company are the negotiating of new franchise rates with half a dozen cities and municipalities, or obtaining authority from a separate commission. The latter course has taken the form of an application for Dominion Charter in the absence of a Provincial Commission.

NOTATIONS ON THE INMAN INVESTIGATING COMMITTEE

There were eight outstanding features in the way of complaints cited against the California Railroad Commission on the part of the city attorneys of California, in the recent hearing of the Inman Investigating Committee of the California State Legislature. These were as follows: (1) There must be better organized rate fixing valuation engineers in the employ of the cities throughout the commonwealth; (2) the municipalities of California should be called together to devise means of keeping the Railroad Commission from dealing with municipal affairs; (3) at present the municipalities, due to lack of finances, are unable to present their case before the Railroad Commission in proper form; (4) the exhibits on the part of the power companies are often so overwhelming that they cannot be successfully refuted; (5) the attitude of the Railroad Commission is to look to the city to refute its own case, whereas, the Railroad Commission being a public body, should handle the city's case for them; (6) city attorneys agreed that the municipalities are unable to make the proper investigations in their own behalf; (7) there should be a closer line drawn between the jurisdictions of where the state regulatory body ends and where the municipality begins; (8) the ready-to-serve charges against the municipalities are the greatest grievances now held against the California Railroad Commission.

VISALIA ELECTRIC COMPANY'S STORE

This entire store, belonging to Scott and Olden of Visalia, California, has been rebuilt according to plans formulated by the California Electrical Cooperative Campaign. Before remodeling, this store was typical of the old electrical "shop" of former years, while today it is a fine example of California's up-to-date electrical stores.

WASHINGTON WATER POWER COMPANY SHOWS INCREASED EARNINGS

Improved earnings in all departments were reported at the annual meeting of the stockholders of the Washington Water Power Company at Spokane.

Large increases in the demand for power were reported, among these being 10,000 horsepower being served to the Pacific Power and Light Company since January 1, 1921, and 10,000 horsepower to be supplied the Intermountain Power Company, beginning October 1 next. To meet these the construction of the new plant in Spokane has been undertaken.

In the annual election of trustees Percy Chubb and Henry C. DeForest, of New York; W. A. White, Frank Lyman, Harold T. White, Theodore F. Hicks, Jonathan Pulkley, Edwin G. Merrill, William L. Frothingham, Guy DuVal, W. J. K. Vanston, New York City; John Adams, Boston; D. L. Huntington, W. F. Coman, J. P. M. Richards, W. J. C. Wakefield, W. S. McCrea, L. M. Davenport, and John D. Porter, Spokane, were placed on the board.

JOBBERS INAUGURATE PUBLICITY CAMPAIGN

The Electrical Supply Jobbers' Association, which has inaugurated a national publicity campaign to tell its customers of the advantage of dealing with the electrical supply

Where Will I Get It?
WHETHER it is for some one unusual thing to meet the unexpected enquiry, or for a bill of material as long as your arm, made up of hundreds of items, you take the short cut when you ask your Electrical Supply Jobber.
The test of time has proved that the Electrical Supply Jobber is headquarters in the Service of Electrical Supplies.
His organization is tuned up to take from stock and get the goods for you. His specialty is having the right goods and making speedy deliveries, just as yours may be equipping a plant, wiring a job or selling electrical merchandise.
When you want what you want when you want it, ask your Electrical Supply Jobber.
Electrical Supply Jobbers Association
311 SOUTH CLINTON ST.
CHICAGO
Ask Your Electrical Supply Jobber

Bulletin issued by Electrical Jobbers' Association

jobber, and to explain to the manufacturer how his representation is being handled, is publishing a series of advertising bulletins.

The accompanying folder, "Where Will I Get It?" is being mailed to a list of 25,000 electrical manufacturers, central stations, industrial plants, electrical contractors and contractor-dealers, telephone companies and street railway companies. This folder is the third of a series which has been mailed since the campaign began in September, 1920.

It is part of the policy of the Publicity Committee to send complete exhibits of all advertising, re-printing the current advertising in the electrical publications, to the jobbers' salesmen, together with a bulletin enlarging upon and urging their interest in the publicity campaign.

TRADE NOTES

Crocker-Wheeler Company Moves —

The Philadelphia office of Crocker-Wheeler Company has removed from its present quarters in the North American Building to 1209 Arch Street. The Philadelphia office has been under the charge of Mr. Samuel Fussell, Jr., since 1897.

Cutler-Hammer Manufacturing Co. Opens New Offices —

A branch of the Chicago office of Cutler-Hammer Manufacturing Company has been opened in St. Louis, in the Railway Exchange Building. Harold Phillips, formerly of the engineering department of Chicago and later office manager of the Chicago office, will be in charge of the St. Louis office.

San Francisco Company Reorganizes —

The Coast Equipment Company of San Francisco, for some time past doing business under the management of L. A. Somers, announces a reorganization under the control of L. A. Somers, H. S. Tittle, Alfred H. Potbury and Robert Dalziel, Jr. The offices of the company have been removed to 766 Folsom Street, San Francisco, where, within a short time, a warehouse stock of meters, motors, transformers and other equipment will be carried.

Meetings of Men in the Industry

(Engineering meetings with especially interesting technical discussions are features of recent organization activities. Local meetings of committees of the Pacific Coast Section N. E. L .A. brought out interesting research work under way.—The Editor.)

Southern Sierras Power Company Holds Annual Meeting

The sixth annual meeting of the officials and employes of Southern Sierras Power Company was held in Riverside, California, from February 17 to 20. These annual meetings are for the purpose of bringing together for reports, discussion and conference the headquarters officials, and the field men of a force covering a territory reaching from northwestern Nevada through east central California to San Bernardino on the south, and thence to the Mexican border at Calexico.

Companies represented in addition to the Southern Sierras were the Nevada-California Power company, engaged principally in supplying light and power to mining camps of western Nevada; Holton Power Company, serving the Imperial Valley; the Imperial Ice and Development Company, which ices cars carrying the early truck and melons to market and also looks after the domestic needs of the valley; Holton Inter-Urban Railway, handling the transportation needs of the region between El Centro and Holtville and other associated companies.

San Francisco Electrical Development League Now Numbers 500 Members

The San Francisco Electrical Development League "went over the top" at their weekly meeting on February 21, by increasing their membership to 500, as a demonstration of appreciation of its retiring president, E. O. Shreve, who had set out to accomplish this during his term of office.

John L. McNab, prominent attorney, and legal counselor for the California State Association of Electrical Contractors and Dealers, was introduced as the speaker of the day by Clyde L. Chamblin, president-elect. The topic of Mr. McNab's address was "Revolution or Evolution—Which?" He discussed the causes of the present conditions in Europe, and the policy which the United States should follow to relieve these conditions and the undesirable conditions present at home.

The League's Lighting Committee reported improved attendance at the Lighting exhibit being held at the offices of the California Industrial Accident Commission, and displayed a chart showing the self interest story from the standpoint of better lighting.

Safety Committee Discusses Inspection Bill

The electrical inspection bill No. 308, which is now before the California Legislature, was the subject of discussion of a meeting of the Joint Committee on Electrical Safety Matters, held in San Francisco on February 9.

Several minor suggestions were made by Mr. Short of the Industrial Accident Commission as to the changes which they proposed making in the bill to make it clear and more definite. All the suggestions offered by Mr. Short were considered by the Committee as an improvement in the proposed legislation.

Mr. Lisberger seconded by Mr. Hardy proposed that the following suggestions be offered to the Industrial Accident Commission, in order that there could be no misunderstanding as to the effect of these rules on public utilities; the following to be added to the introduction to the bill:

"Nothing within this act shall be construed as to require public utilities to take out licenses or secure permits for work done in the regular conduct of their utility business, but these utilities shall be required for acting as contractors and doing work on the premises of the consumer to comply with the requirements of this act."

This was submitted to the Commission in memorandum form through Mr. Short.

Vancouver Electric Club Addressed by General Manager of Power Company

The Vancouver Electric Club was addressed on February 11 by George Kidd, general manager of the B. C. Electric Railway Company, briefly on the subject of the company's application for a federal charter. Mr. Kidd stated that the company had had an increase in power demand of nearly 20 per cent in the last year, although there was at present a lull. He expected this soon to be over and the increase again to go on in the spring. If this increase kept on, the company would undoubtedly need to expend several million dollars on a new plant soon and for this reason it was imperative that its revenues be put on a secure basis. It had power to charge a 6-cent fare in Vancouver only to the end of June. After that it would be forced to charge only the fare allowed in its franchises unless something intervened. Mr. Kidd said the company could not operate and would not attempt to operate on a 5-cent fare. On such an insecure basis no investor would put further money into the company's securities.

At the close of the address W. W. Fraser, president of the Vancouver Association of Contractors and Dealers, read a resolution passed by the executive committee of the National Association of Contractors and Dealers pledging support to central stations. Mr. Fraser urged that the Electric Club support the B. C. Electric Railway Company in its application for a Dominion charter and promised to bring the matter before the Contractor-Dealers' Association. The club passed a resolution endorsing the B. C. Electric Railway's application and several members urged that a petition be circulated for signature. This will be taken up by a committee appointed for the purpose.

Technical Committee of Pacific Coast Section of N. E. L. A. Held in San Francisco

At the 220,000-Volt Committee meeting of the Pacific Coast section of the N. E. L. A., Professor H. J. Ryan described some very interesting studies of the causes of flashover on strings of insulators. He pointed out that it is essential to prevent the first formation of corona in order to prevent later complete spill-over.

R. J. C. Wood told of some interesting tests made in collaboration with Professor Ryan on various combinations of insulator strings, and J. P. Jollyman told of the investigations being made by Pacific Gas & Electric Company on insulators for their 220,000-volt Pit river line. A feeling was generally expressed that the problem of insulation of higher voltage lines is in the way of being solved through the use of suitable guard rings which will better distribute the electrostatic strain around the line units.

The following committees also met: Relay, Work of Load Dispatcher, Safety Rules, Meters, Overhead Systems, Rates Based on Power Factor, Inductive Interference, Electrical Apparatus, Underground Systems, Insulator Research, and Power Resources of California.

Land Improvement and Flood Control Subject of Meeting

The regular bi-monthly meeting of the San Francisco section of the A. S. C. E., on February 15, was devoted to the topic "Land Improvement Works in the Central California Flood Basins." Fred H. Tibbetts, irrigation engineer, gave an illustrated talk on developments under way and projected; F. F. Cooper, of the Olympian Dredging Company, explained the construction and operation of world's record dredges, and Robert Shurman, of the Byron Jackson Iron Works, spoke on the installation of large drainage pumps.

Seasonal Weather Forecasting Conference Has Good Attendance

The weather forecasting meeting held February 18 in San Francisco and attended by over fifty engineers of the Pacific Coast, was for the purpose of learning what has been done in the past to make seasonal forecasts of weather conditions and what might be done in the future along this line.

Mr. E. A. Beals, local forecaster of the Weather Bureau, told of the work done throughout the world in the past on this subject.

Dr. A. E. Douglass, of the University of Arizona, pointed out that there is unquestionably a distinct relation between the occurrence of sun spots and precipitation, as the results of over one hundred thousand measurements of tree rings from trees throughout the world has conclusively proven that the width of the tree rings vary approximately as the number of sun spots, the variations in the tree rings being due, of course, to the annual precipitation.

Dr. C. F. Brooks, Major Bowie, and Professor Henry of the Weather Bureau of Washington, D. C., presented papers on the subject of seasonal forecasting.

Dr. G. F. McEwen, Oceanographer of the Scripps Institution of the University of California at La Jolla, California, gave the results of four years' investigations of the relation between the temperature and salinity of the ocean water and the subsequent precipitation.

It was decided that every effort should be given by those who are in a position to make further studies on this subject.

After-Luncheon Talk at San Francisco Engineers' Club

M. M. O'Shaughnessy, city engineer of San Francisco, spoke to the members of the San Francisco Engineers' Club on February 17, on the subject of "What Do We Get in Purchasing Spring Valley Water?" Mr. O'Shaughnessy spoke of the proposed purchase of the properties of the water company, which will be voted upon by the people of San Francisco early in March, as the most important subject of vital interest to the welfare of the community.

Seattle Section A. S. M. E. Greets National President

The Seattle local society of the Washington Section of the American Society of Mechanical Engineers on Feb. 18 and 19 entertained as its guest Edwin S. Carman, of Cleveland, Ohio, president of the American Society of Mechanical Engineers. On the evening of Feb. 18 the Seattle section met at a dinner at Blanc's Cafe and were later addressed by President Carman. W. L. Newell, president of the Seattle section, which comprises a membership of fifty, presided at the meeting.

Denver Section of A. I. E. E. Has Radio Demonstration

The Denver section of the American Institute of Electrical Engineers was host to the member societies of the Colorado Engineering Council at a meeting held in the Albany Hotel on February 17. W. N. Winner, instructor in vocational training, Radio Service, at United States General Hospital No. 21, gave a radio telephone demonstration, explaining the construction, use and operation of the modern wireless telephone. Messages from various parts of the country were received.

Seattle Section A. S. C. E. Elects Officers

At the annual meeting of the Seattle section, A. S. C. E., held in the Chamber of Commerce rooms, Arctic Building, January 31, the following officers were elected to serve during the ensuing year: T. E. Phipps, president; Bertram D. Dean, vice-president; Frank H. Fowler, secretary-treasurer.

The meeting was attended by 45 members, 13 members of the University of Washington student chapter, and four guests. Preceding the meeting, a dinner was held at Blanc's Cafe. Speakers during the evening were: E. M. Chandler, member A. S. C. E. and chief engineer, State Reclamation, who gave a very complete analysis of the Smith-Fletcher bill now before Congress, and also of the activities of the State Board of Reclamation; Commander H. N. Beck, U. S. S. Explorer, member A. S. C. E., gave an interesting description of recent work in Alaska, discussing the use of sweeps to locate pinnacle rocks, this talk being illustrated by lantern slides.

A telegram was read from Senator Crocker of the parent society, stating that the Board of Direction had authorized the formation of a student chapter. A letter was also read from King County Engineer T. R. Beeman, member A. S. C. E., outlining the policy of his department as regards competition with practicing engineers.

COMING EVENTS

PACIFIC COAST SECTION, NATIONAL ELECTRIC LIGHT ASSOCIATION
Annual Convention—Del Monte, California, May 25-27, 1921

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
Annual Convention—Salt Lake City, Utah, June 20-24, 1921

NATIONAL ELECTRIC LIGHT ASSOCIATION
Annual Convention—Chicago, Ill., May 31-June 1, 1921

AMERICAN SOCIETY OF MECHANICAL ENGINEERS
Spring Meeting—Chicago, Illinois, May 23-26, 1921

OKLAHOMA UTILITIES ASSOCIATION
Annual Convention—March 8-10, 1921

CALIFORNIA STATE ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS
Annual Convention—Santa Cruz, June 16-18, 1921

Clark Speaks Before Seattle Engineers

The February meeting of the Seattle section of the A. I. E. E. was held in the Chamber of Commerce assembly room, Arctic Building, on February 14. Preceding the meeting a dinner was held at the Butler Hotel. Robert W. Clark, of the Puget Sound Power & Light Company, spoke on the subject, "Giving the Kilowatt a Show." Mr. Clark is chairman of the Advisory Committee of the Northwest Electrical Service League.

Spokane Section of A. I. E. E. Has "Movie" Meeting

The Spokane section of the American Society of Electrical Engineers was entertained at their February meeting in the Davenport Hotel, by a four-reel motion picture, "Coal Is King." The picture dealt with all forms of power plant practice, good and bad methods of firing, heat losses, steam losses, and lessons in economy. The picture was produced by the Ford works under the direction of the Diamond Power Specialty Company of Detroit.

Builders' Convention Will Be Held in Spokane

The Northwest Master Builders' Association and the Associated General Contractors of the Pacific Northwest will meet on March 1-2-3, for the third annual convention of these two bodies. Besides a staff of speakers of national reputation who will address the convention, there will be a general discussion of the pressing problems that today confront the building industry. A large number of leading contractors and master builders of the Northwest will be in attendance.

Wireless Demonstration Given at A. I. E. E. Meeting

A practical talk on modern methods of radio communication by Capt. C. T. Hoppough, Signal Corps, U. S. A., was the feature of a meeting of the San Francisco section of the A. I. E. E. on February 25. Capt. Hoppough, who is the chief radio officer at Fort Mason, with ten years' continuous practical experience in radio work, is considered an authority on the latest developments of that industry. He described briefly what modern radio equipment is and what it is designed to do; what service different types of equipment were best adapted for; what special problems attend radio telephony, and other phases of the subject. As a special feature, apparatus was installed by the Colin B. Kennedy Company which permitted audible signals of Atlantic stations to be heard by the members.

LATEST IN EVERYTHING ELECTRICAL

(An automatically operating button push switch for illuminating the running board of automobiles has been developed by the Bryant Electric Company, as well as two new types of plugs. Cutler-Hammer has put out an improved auto-transformer starter.—The Editor.)

TWO NEW SPARTAN DEVICES

The Bryant Electric Company of Bridgeport, Conn., have added two new

Two new Spartan devices designed to protect the wiring on disconnecting plugs

devices to their line of Spartan Standard Plugs and Receptacles.

The brass covered cap shown has a patented bushing which is threaded into that face of the cap whence the connecting cord issues.

The hole in the bushing has a number of inwardly projecting bosses which serve to securely grip the outer surface of the wire around its entire circumference. Thus the strain on the wire, as when the plug is pulled out of the receptacle, is taken by the bushings and no strain put upon the wire under the binding screws—a particular advantage which will readily be appreciated by users. The threading which takes the strain-relief bushing is standard ⅜-in. iron pipe size. It is therefore possible to attach the cap to socket handles, etc. This device is identified by the manufacturers' trade number KN, where reversible blades are desired, or by number MN for polarity service.

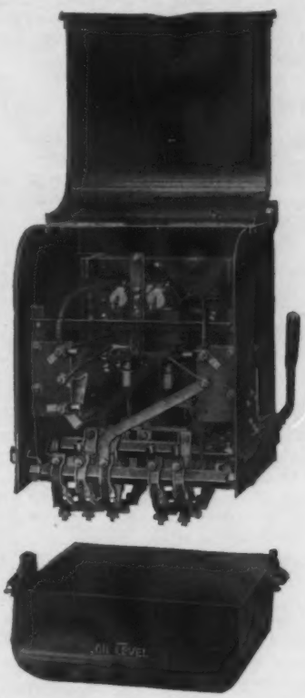
The other device shown is an adapter made of substantial molded insulation. As will be noted, it consists of a combination Spartan standard parallel blade plug and an Edison base receptacle. It affords a most convenient means for connecting devices with Edison attachment screw plugs into service in the more modernly equipped office or residence, where Spartan receptacles have been installed. The catalog number given by the manufacturer to this device is KL.

BRYANT AUTOMOBILE DOOR SWITCH

For automatically illuminating the running board or step and the entrance to closed automobiles, the Bryant Electric Company has developed a button push switch which operates automatically to close the circuit and light the inside lights when the car door is opened. The shell within which is fastened the switch mechanism is of sheet brass with heavy fibre back to form the insulated base for mechanism and crew terminals. This shell is of the smallest practical dimensions— 1 x 1½ x ¾ in.—so as to minimize the size of recess hole necessary to be cut into door frame.

NEW C-H AUTO-TRANSFORMER STARTER

The engineering department of the Cutler-Hammer Manufacturing Co. has developed an auto-transformer starter, for the starting of standard squirrel cage motors of various capacities ranging from 5 to 100 hp. The starter has the following features of design: No wood or castings used in the construction; fingers have wiping action and are of non-stubbing type—easily adjusted and renewed; operating handle can be moved to "running" position only from "starting" position; motor protected against overloads by duplex relay with



Interior view of starter with oil tank lowered and cover thrown back

true inverse time limit movements; relay and terminals made accessible by lifting cover of starter case; removal of oil tank is one-man job, made so by special construction of holding clamps.

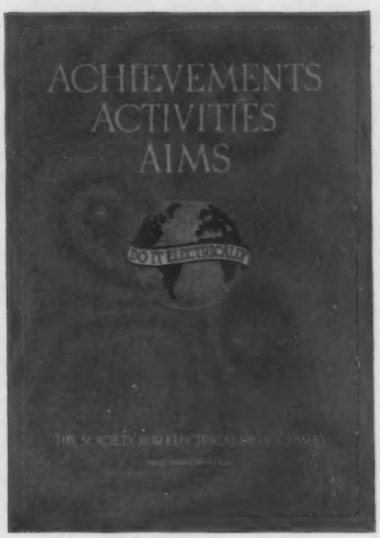
ESCO MOTOR CATALOG

The Electric Specialty Company of Stamford, Connecticut, announces a loose leaf catalog which comprises Bulletins 217 to 225 published by that company, and describes the different types of motors which they produce.

Books and Bulletins

"Do It Electrically"

The Society for Electrical Development, which unites all branches of this many-sided industry, and is dedicated to the promotion of industrial cooperation,



Cover of the booklet of the Society which has given world-wide publicity to the slogan, "Do It Electrically."

has published an extremely interesting booklet wherein a description is given of the work the society is doing. The booklet embraces a comprehensive resumé of its achievements, activities and aims, where it is located, and how it has grown, since its inception in 1914. It contains much interesting data and many helpful hints to those who are interested in affecting the public mind and making it more receptive to the advantages offered by electric service. The society is in a position to plan and furnish details for individual goodwill campaigns, and is equipped most thoroughly to carry out its aims and purposes. The booklet also contains a list of several other publications which have been prepared by the society, and which it supplies to its membership.

Battery Charging Rheostats Leaflet

The Ward Leonard Electric Company of Mount Vernon, New York, is publishing a leaflet which is a directory of the Vitrohm Battery Charging Rheostats. This leaflet is in note book form and so punched that it can be inserted in a binder.

NEW ELECTRICAL DEVELOPMENTS

(The Pacific Northwest seems to be in the midst of a boom of industrial development, by the reports of new construction from that district. The Pacific Southwest has several bond elections scheduled, and the Intermountain district features filings for hydroelectric development.—The Editor.)

THE PACIFIC NORTHWEST

SNOHOMISH, WASH.—The Columbia Packing Company, recently organized, will erect a modern cold storage packing plant here, costing $30,000.

CENTRALIA, WASH.—The contract for a white way lighting system, with six lamp posts in each block, has been let to the Western Electric Company.

TACOMA, WASH.—The City Light Department has awarded to Home Electric Company a contract for furnishing a year's supply of transformers, the contract totaling $25,000.

PORTLAND, ORE.—An $800,000 flour mill will probably be erected by the Fisher Flouring Mills, within the next year, on a site owned by the company, located below the Broadway bridge.

PORTLAND, ORE.—Plans have been announced for the construction of a nurse's home, heating plant, and the first wing of a new hospital group, to cost $225,000, for the Emanuel Hospital.

MEDFORD, ORE.—The Talent Lumber Company, which has just been incorporated for $150,000, will erect at once a modern electric sawmill, box factory and retail lumber yard, in the town of Talent.

KLAMATH FALLS, ORE.—Installation of a town of several hundred homes, as headquarters for the logging operations of the Long-Bell Lumber Company in cutting their 100,000-acre tract east of Bray, California, will be completed this year, according to a report in lumber circles.

PORTLAND, ORE.—A building program calling for the expenditure of approximately $700,000 within the next year, has been announced by the school board of Multnomah county. A new grade school costing $300,000, and a new high school costing $250,000, are included in the plans.

VANCOUVER, WASH.—A large pulp and paper mill will be constructed by the Oregon-California paper mill interests on the site of the old Pittock-Leadbetter mill, according to reports. A saw mill may be operated in connection with the plant.

SALEM, ORE.—Articles of incorporation have been filed by the Pe Ell Light & Power Company. Trustees: C. E. McCoy, Czarina McCoy, E. S. Snelling. Capital: $10,000. Place of business: Pe Ell. Purpose: To handle all kinds of electrical supplies, and manufacture and supply electricity.

SEATTLE, WASH.—A total of thirteen bids was received by the city of Seattle for lighting and wiring contract on the west transit shed of Pier B, the bids ranging from $7076 to $4750. Low bid was submitted by Meacham & Babcock, at $4750, with an alternate bid of $3053, an estimate on labor cost.

DALLAS, ORE.—The Mountain States Power Company has recently placed in operation a 1000-kw. turbine, making the total capacity of their plant here 2100 hp. Most of the capacity of the new machine will be used in supplying power to the new electrically operated saw mill of the Willamette Valley Lumber Company.

MEDFORD, ORE.—It is reported that the Blude Ledge Mining Company will begin construction early in the spring of a $50,000 electric power plant for its big copper mine over the California line in the Medford district, the present capacity of the mine to be doubled. Power will also be provided for other mining work in the district.

PORTLAND, ORE.—The output of the United Manufacturing Company will be trebled as the result of increase in the plant and equipment now being made, according to the announcement of M. Tarlow, president and general manager of the concern. The extension of the plant, which manufactures mattresses, comforters, springs and English breakfast tables, together with the installation of new machinery, will cost about $53,000.

PORTLAND, ORE.—A five-day conference of railway officials has resulted in a decision that the Union passenger station shall be used by all the railroads entering the city. This agreement will make it necessary for many changes in trackage and in the construction of buildings and other terminal facilities. There will be a mammoth freight terminal developed in the Guilds Lake district for the use of all railroads, to relieve the congestion at the Union station, and provide additional track facilities for passenger service.

THE PACIFIC CENTRAL DISTRICT

MODESTO, CAL.—Notices to contractors will be sent out at once by Modesto and Turlock irrigation districts, announcing that bids for Don Pedro dam will be received.

DAVIS, CAL. An election was held Feb. 21 to vote $50,000 bonds for a complete sewer system and $4,000 to meet the cost of boring a well to meet the requirements of water for domestic purposes.

COTTONWOOD, CAL.—Pacific Gas & Electric Company is to erect a substation and power line. A steel tower line will be built to connect the Pit river project with the lines of the company in the neighborhood of Marysville.

RICHMOND, CAL.—A factory site in Richmond is being considered by A. D. Bowen, of the Bowen Motor Railways Corporation of St. Louis, who has returned here from Los Angeles to continue his search for a location for a manufacturing plant.

OAKLAND, CAL.—That the Pacific Gas & Electric Company will erect a new office building to take care of the increased business, was the statement made by John A. Britton, vice-president of the company. The new office building will probably be erected at Seventeenth and Clay streets.

BERKELEY, CAL.—Installation of fifteen new 250-candlepower lights on Berkeley street corners was ordered by the city council on the showing of Councilman E. T. Harms that the corners were without sufficient light to insure safety to the general public. Increased candle power of lights now in use at ten additional street intersections was also ordered.

OAKLAND, CAL.—The California Rubber Company, a California corporation capitalized at $5,000,000, will erect a plant for the manufacture of cord tires, circular inner tubes and rubber goods, in the industrial district of San Francisco Bay, presumably in Alameda county. The first unit of the plant will employ about 700 men per 8-hour shift.

LODI, CAL.—Samuel Kahn, vice-president and general manager of the Western States Gas & Electric Company, has made the announcement that the company has purchased 150 miles of copper wire to rebuild the transmission line of the Western States between Natoma and Lodi. Delivery of this wire is expected soon and the work of stringing it will begin immediately upon receipt.

DUNSMUIR, CAL.—The new street lighting system of this city is being installed by the California Power Company. This will brighten the gloom that has enshrouded the streets recently. Since meters were put in the householders have been economizing porch lights, which formerly, on the flat rate system, burned twenty-four hours a day, giving ample light for the streets.

SAN FRANCISCO, CAL.—The largest contract for material for the Hetch Hetchy work awarded for several months since the Construction Company of North America has been in charge of the tunneling of the mountain division, was made when the Board of Public Works accepted the bid of the Western Pipe and Steel Company of $16,726. The amount is for 10,374 feet of air pipe and 550 cinch bands, to be delivered at the Hetch Hetchy Junction within the next thirty days.

OROVILLE, CAL.—With the filing by the Great Western Power Company of application for a permit to build a dam reservoir and conduit eighteen miles long to a power house on the North Fork of the Feather river, it is believed that actual construction of the mammoth hydroelectric plant above Oroville will be started soon. The plant is to cost $6,000,000. That the Great Western intends to start construction of the local plant at an early date is indicated in that the petition recites that the company wishes to develop about 5200 horsepower in Butte county near Oroville.

OAKDALE, CAL.—The Oakdale irrigation district will have electrical power valued at $600,000 annually when the new Melones dam is completed, according to the statement made by Director H. B. McMath of Riverbank, and he has been instructed to confer with H. H. Wadsworth, consulting engineer of the board, in order to secure further data. Other engineers have told the board that the water power possibilities of the dam were not very great. McMath claims that the district will be able to sell the power for enough to pay for the bonds, and also all the other interest on outstanding bonds for the district, and that the land owners would be able to get water for themselves without cost.

GRASS VALLEY, CAL.—Ordering the dismissal of the complaint of the Western States Gas and Electric Company against Joseph Swansborough, the Railroad Commission today suggests to the utility that it give to Swansborough the extra water for irrigation purposes he had asked for. Swansborough had been getting 106 miner's inches of water from the Summerfield ditch in Placer county which is owned by the Western States Company. He asked for an additional five inches. The company claimed that it needed the water for hydroelectric purposes and appealed to the Railroad Commission to determine whether the demand for extra water should be met.

THE PACIFIC SOUTHWEST

SANTA ANA, CAL.—Work will be started soon on the new home of the First National Bank of this city, to cost $300,000.

PHOENIX, ARIZ.—An ordinance was recently adopted providing for the sale of $655,000 of bonds for water, sewer and lighting.

LONG BEACH, CAL.—F. B. Dunn, Laughlin Theater Building, is planning the erection of a hotel at East Ocean Boulevard and Ocean Avenue, to cost $1,125,000.

CASA GRANDE, ARIZ.—A special bond election will be held March 12, for the purpose of voting on a bond issue for extending and improving the municipal light and power plant.

SAN DIEGO, CAL.—A bond issue of about $500,000 will be called for completing Bartlett dam and to enlarge Morena spillway. Plans are now being prepared by the engineer's office.

PASADENA, CAL.—Plans have been prepared by the Austin-Murphy Company for a community residence court to be erected on the property of B. O. Kendall Co. in Oak Knoll. It will cost $500,000.

PASADENA, CAL.—William Crowell of Pasadena has taken out a building permit in the amount of $60,000, for the construction of a physical laboratory for the California Institute of Technology.

SANTA ANA, CAL.—J. S. Fluor has been awarded the contract for the erection of a new substation on South Main Street for the Southern California Edison Company, to cost $250,000 for building and equipment.

LOS ANGELES, CAL.—The Constant Angle Arch Dam Company has been awarded a contract by the Board of Supervisors of Los Angeles County for the construction of the Pacoima dam, which will cost about $1,500,000.

OJA, CAL.—It has been announced here that the State Engineer will make a thorough inspection at an early date with reference to the construction of a storage dam in Mantilija canyon to provide irrigation water for this valley.

RIVERSIDE, CAL.—Plans for construction of a porous dam 600 feet long and costing about $9,000, for the proposed protection of the pumping plant site on the edge of the Santa Ana river below Rubidoux mountain road, were recently submitted by the Platt Flood Control Company.

SANTA ANA, CAL.—The city of Santa Ana has made application for water rights in the watershed of Santiago Creek so as to provide a storage water supply for this city. The project includes the construction of a dam one hundred feet high which it is estimated will impound 7,000,000,000 gallons of water.

LOS ANGELES, CAL.—John Hayes has the contract to bore a tunnel in Second Street to connect Broadway with a new thoroughfare serving Hollywood traffic. The job will cost $1,000,000. This has been the source of much litigation which now seems to be out of the way and it is generally understood that work will soon be commenced on this important improvement.

LOS ANGELES, CAL.—Plans outlined by the Board of Education call for the expenditure of $2,000,000 for elementary schools and $3,000,000 for intermediate and high schools. Most of this work will be undertaken during the current year. These contracts, together with the supplies to equip these schools, will open up an attractive field to all contractors and dealers interested in this line of work.

SANTA FE, N. M.—Daniel L. Evans, of Philadelphia, has notified the state engineer's department of his intention to apply for 1,000 second-feet from the Rio Grande at the Woody's bridge dam site for power purposes. Evans explained, in his notice, that by building a power plant at the Woody's bridge site it was planned to get the full power of the stream during low stages before the water reached the primary works—the proposed dam and power plant at the mouth of the White Rock canyon.

LOS ANGELES, CAL.—An expenditure of $113,000 will be made by the Bank of Italy in remodeling their building at 220 North Spring Street. A. C. Martin is the architect and Pozzo Construction Company, 421 Macy Street, are the contractors.

SAN DIEGO, CAL.—The Ross Construction Company, with offices in the Van Nuys Building, Los Angeles, has a contract to construct a marine railway for the Federal Government at the fleet repair base recently acquired by the Navy Department in San Diego.

CHANDLER, ARIZ.—A bond election for the Auxiliary Eastern Canal irrigation district will be held February 19, for $2,000,000, for the purpose of carrying out the plan of the board of directors in the acquisition and construction of irrigation works for this district. A pumping plant capable of raising 350 second-feet of water from Eastern Canal to a height of 50 feet, and the right to divert via Granite Reef dam, flood and surplus waters of the Salt and Verde rivers through eastern and southern canals to the pumping plant, are contemplated.

EL PASO, TEX.—One of the first projects of the Chihuahua Government will be the reclamation of approximately 360,000 acres of barren land, according to Benjamin R. Enriquez, brother of Governor Ignacio Enriquez and chief engineer of the irrigation project. Canals will be constructed from Boquillas dam on the Rio Conchos through the country from Santa Rosalia to Chihuahua, and a dam will be built in San Pedro river with a capacity of 1,000,000,000 cubic meters, to cost not less than $15,000,000. He also stated that three other dams will be constructed west and northwest of the city.

PHOENIX, ARIZ.—Arizona is about to reclaim another big desert valley. Eighty-five thousand acres in the Paradise valley are to be brought under irrigation by means of a reclamation project costing approximately $15,000,000.

Announcement by George D. Christy, Phoenix, counsel for the Paradise-Verde irrigation district, as the association of landholders is known, that the financing of the project has been arranged in complete detail, has been followed by preliminary engineering work on the reservoir and damsites. Several hydroelectric power plants, planned to develop 5000-hp., are to be constructed. All canals and laterals are to be of concrete construction in order to minimize loss of water in transit from the reservoirs from the lands to be served, Mr. Christy said.

THE INTER-MOUNTAIN DISTRICT

MOSCOW, IDA.—The city of Moscow is contemplating the installation of an ornamental street lighting system in the business part of town. Approximately 100 lamps will be installed.

TREMONTON, UTAH.—The Utah Power & Light Company has just completed an extension to serve about forty homes in East Tremonton, a prosperous farming community of Box Elder county, Utah.

LOGAN, UTAH.—Several towns in Cache county and the Bear Lake district, including Preston and Montpelier, Idaho, and Richmond and Trenton, Utah, are considering extensions to their street lighting systems.

SALT LAKE CITY, UTAH.—The Public Utilities Commission of Utah has issued a certificate of convenience and necessity to the Utah Power & Light Company, giving that company permission to put a transmission line through Tooele county.

PIOCHE, NEV.—Work is to be started immediately on the sinking of the main working shaft of the Prince Consolidated Mining Company. The power plant has been placed in first-class operating condition, and the pumps will commence unwatering the shaft at once.

BOISE, IDA.—The Elmore Copper Company has filed application with the Federal Power Commission to build a dam from fifty to ninety feet high in Boise river, Elmore county, Idaho, backing the water up the river for a distance of three miles. The contemplated power house would be located at the dam and would develop 3,000 horsepower.

MOAB, UTAH.—The Moab Light & Power Company has made some changes in its distribution circuits on Main Street. Street lights will be placed on each side of the street, doing away with the line of poles in the center of the street. The removal is made necessary in order to grade and shale Main Street as a part of the state highway.

HELENA, MONT.—The Butte Electric Railway Company operated in 1920 at a loss of $9,207.98, according to the statement filed with the Montana Public Service Commission by that utility. The statement showed that the company made a profit of $324.86 for the month of December, 1920, after the higher street car fares were granted by the commission.

MILLER, NEV.—An electric power line from Millers to the Simon district is being surveyed, and construction will commence soon. The distance is about thirty-eight miles, air line. The line will be constructed and owned by the Simon Silver-Lead Mines Company and will serve other properties that desire electric power. The Nevada-California Power Company will supply the power.

RENO, NEV.—Plans of ranchers in Long Valley, Lassen county, California, to use water from the Little Truckee river will be vigorously protested by the Truckee River Water Users' Association. This is according to Judge P. A. McCarran, president of the association. Every action which would result in a reduced flow of water for the Newlands project from Little Truckee is being closely watched.

SALT LAKE CITY, UTAH.—All records in the Salt Lake land office have been broken, in the number of applications filed to prospect for oil in Utah. Fifteen applications, for an aggregate of 70,000 acres in San Juan, Garfield, Wayne and Emery counties were received in one day. Many of the applicants are residents of cities as far east as Chicago, though the majority are Salt Lake and Utah people.

SALT LAKE CITY, UTAH.—The contract to furnish incandescent lamps to the state institutions of Utah has just been awarded to the Western Electric Company. There were five bids submitted and all were the same, being computed on a $2500 basis, with discounts of the same amounts for other supplies furnished. Last year the contract amounted to $3700 in all, and was awarded on practically the same basis.

BOISE, IDA.—The city has filed an application with the Federal Power Commission for permission to build a seventy-five foot dam on the north fork of the Payette river to store 1150 acre-feet of water and to develop 12,000 horsepower for municipal use. Permission is also asked to build a pipe line and tunnel to a power house on the south fork of Payette river, and a second dam to be erected on this stream which will store 1150 acre-feet.

OGDEN, UTAH.—In addition to the municipal improvements contemplated in a proposed bond issue of approximately $1,750,000, among which is a municipal electric power plant, the city commissioners of Ogden have adopted the recommendation of the city engineer that $300,000 be appropriated by the city for the development of the Skull creek dam site and reservoir. It is proposed to build a masonry dam and construct a reservoir and pipe line to connect with the city water supply system at the artesian wells in Ogden valley, thus increasing the city's water supply.

Yellow journalism is at work on our reputation—witness this headline from a daily newspaper:

"FEDERAL GOVERNMENT TO AID SALVAGE"

In stating that this report is entirely without foundation, we venture to remark that we think we are quite funny enough. There is moderation in all things.

* * *

THE PASSIONATE ADVERTISER TO HIS LOVE

Dullest of poetasters I
And weakest of elegiasts;
Give me your lips! They satisfy!
Kiss me again! The flavor lasts!

'Tis love that makes—you know the rest.
Our love shall kodak as it goes,
With pictures better than the best,
Geared to the road. Ask Dad—he knows.

Our home shall be of softest stuff,
Wooltex and Satin-O and such; you
Shall never find the going rough,
No metal, O my love, can touch you.

I am the Better Sort you need;
I'm glad as a Contented Cow;
My love endures. It's guaranteed.
. . . Eventually! Why not now?

—(Borrowed from somebody who borrowed it from the New York Tribune.)

* * *

Statistics again. Some delirious creature has worked out that "there are 21,718,448 cigars burned up in the United States every twenty-four hours, and over 23 million cigarettes. The money spent by smokers for cigars alone would build a fleet of thirty-five trans-Atlantic liners, each exactly like the lost Titanic, coal them, provision them and keep them running between New York and Liverpool with a full complement of passengers and crew, almost indefinitely."

And the amount of money spent on peanuts and candy would build and furnish sixty-six hotels each exactly like the Waldorf Astoria, set them on wheels, and keep them running between New York and San Francisco with a full complement of millionaires and waiters, almost indefinitely. At least we dare say it would. Anybody who doubts it can work it out and argue with us.

* * *

Another bright soul has invented an electric manicure set, described as follows:

". . . an outfit consisting of a small electric motor attached to which is an adjustable shaft or flexible arm. To this she will connect circular file, emery board or buffer, and the motor will do the work in a jiffy."

All we can say is that this invention is likely to ruin the manicure business. Does the poor benighted inventor suppose that it is speedy work that is the attraction in a manicure establishment?

Rate-fixing in Japan is a very cheerful process, judging by the following item which we reproduce from a Japanese paper:

"After considerable amount of time had been spent in negotiation with the consumers, —— Electric Co. of —— has decided to increase its rates by 40 to 50 per cent."

How do they do it?

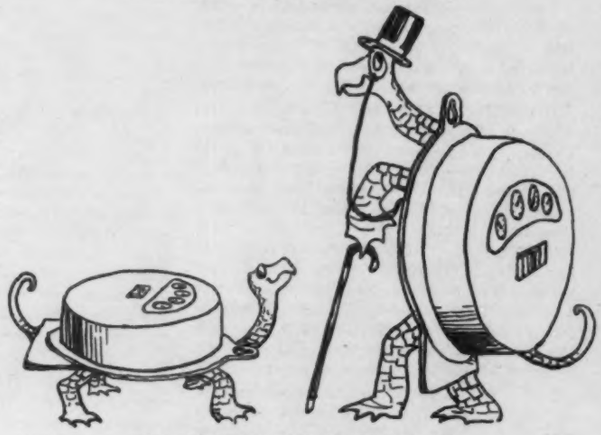
* * *

These electrical homes are sometimes more trouble than they are worth to the stranger within our gates. We are thinking particularly of a card pasted over the bell on the front door of a house in a little Pennsylvania town. It read as follows:

"Button doesn't bell. Bump."

* * *

ELECTRICAL HYBRIDS — IX, X



The Metertle and the Meterrapin

"Oh, where are you going to, Meterrapin?"
The Metertle asked as he passed.
"For though you're reliable really, that hat
Makes you look most atrociously fast."

"Go to," said the other, "for though I may look,
With this hat and this cane, somewhat fleeter,
To my one current love I am faithful, I swear,
And am going, as ever, to meet 'er."

The Metertle sighed, "It were meeter, methinks,
To keep up one's steady appearance;
Move slowly and surely; let nothing get by;
And never invite interference.

"There's none will believe, when you're dressed up like that,
That you haven't been changing your pace;
And the worst of it is, as you know very well,
It all shows itself in your face."